

m/035/015

Kennecott Utah Copper Corporation  
Tailings Modernization Project  
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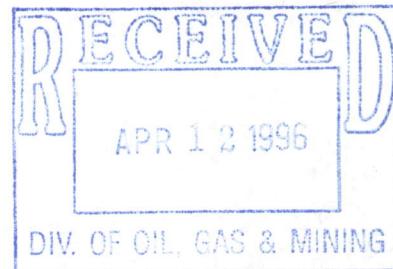
**Robert E. Dunne**  
Project Manager

April 9, 1996

**Kennecott**

Mr. John Whitehead  
State of Utah  
Department of Environmental Quality  
Division of Water Quality  
288 North 1460 West  
P.O. Box 144870  
Salt Lake City, Utah 84114-4870

Dear Mr. Whitehead:



Re: Response to March 26, 1996 letter regarding additional information for the Tailings Acidification Potential Study

Following is the information requested in your letter dated March 26, 1996:

**Question 1:** Complete text and figures of Schafer and Associates static test protocol, SOP A-1, describing neutralization potential methods used, and/or other protocol statements for test methods that were used in the work.

**Response:** A copy of the static test protocol, SOP A-1, is attached (Attachment 1).

**Question 2:** Dates of sample collection and analytical testing for all 240 samples cited in the Kennecott report.

**Response:** Dates have been added to the tables in Appendix H; enclosed please find the amended tables for Appendix H (Attachment 2).

**Question 3:** Copies of laboratory ABA test reports for all 240 samples cited in the Acidification Potential report. These results should include values for NP, AP, ABA, and total sulfur. All data should be in standard units and dimensions.

**Response:** Copies of all test results are attached (Attachment 3).

**Question 4:** A revised version of the metal content (Table H.7) for appendix H is needed to include sample dates, analytical test dates, analytical results in standard units and dimensions, and protocol statements for the methods used in the analysis.

**Response:** an amended Table H-7 is attached (Attachment 4). The method used by KEL for the metals analyses was EPA method 3050 (Revision 2, Jan. 1995) and EPA method 6010 (Revision

2, Jan. 1995).

**Question 5:** Complete protocol statements for all kinetic test methods in the report. If KUC has developed conclusions regarding the utility of mini-columns for the kinetic testing of tailings, a write-up of those results and conclusions would be useful.

**Response:** A copy of the kinetic test method is attached (Attachment 5).

As stated in the Acidification Report:

"In general, the mini-columns yielded similar predictions for the potential for acidification of the samples as did the humidity cells, but with less intense oxidation (release of SO<sub>3</sub>). The predictions for releases of metals were also similar. Based on these results, it appears that the mini-columns offer a useful, low-cost alternative to standard humidity cells."

**Question 6:** A more complete elaboration of any evaluation of alternative closure methods cited in the conclusion number 11 in section 8 of the Kennecott report.

11. After closure of the North Expansion Impoundment, patches of acidification will develop, similar to the south side of the existing tailings embankment. The patchy acidification would be controllable by means of surface applications of lime, with other soil amendments to encourage growth of vegetation. Alternative methods for closure of the North Impoundment are also being evaluated to minimize the risk of generation of acid.

**Response:** As stated in Section 4.3.2 of the Acidification Potential report, field monitoring is being conducted on a constructed test fill. The test fill was constructed along the southern embankment and contains a ten-foot lift of cyclone underflow.

Several alternative closure options are being evaluated on the test fill (see figure 4.3. Acidification Potential report). The goal of these reclamation techniques is to prevent acid generation, thus permitting perennial vegetation to control fugitive dust. The closure options include: (1) no vegetation, (2) Vegetated tailings, (3) placement of a lift of cyclone overflow incorporated with limestone and vegetated, and (4) placement of a lift of overflow followed by vegetation.

Additionally, Groundwater Discharge Permit No. UGW350011, Part 1 Section K Item 9, requires Kennecott to submit within 1 year of permit issuance, a closure plan for the existing and expansion portions of the Tailings Impoundment. This plan will include details on all aspects of closure or schedules milestones for any issues that require further study.

**Question 7:** A summary of the data obtained to date for oxygen and water within the existing impoundment and test fill.

**Response:** A report summarizing the results from these two monitoring locations is currently being prepared and will be submitted upon completion.

Should you have any questions, contact me at 252-2801 or Paula Doughty at 252-2806.

Very truly yours,



R.E. Dunne  
Project Manager

Enclosures

c: Mr. Wayne Hedberg, DOGM  
Dr. Gene Farmer  
Dr. Ric Jones, w/o enclosures.

# **STANDARD OPERATING PROCEDURE**

## **NEUTRALIZATION POTENTIAL**

### **LIME AS CACO<sub>3</sub>**

#### **APPROVED BY:**

Originator	Date
Technical Reviewer (if applicable)	Date
ELI Quality Assurance Officer	Date
ELI Laboratory Manager	Date

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Soils Laboratory

#### **1.0 SCOPE AND APPLICATION**

The amount of neutralizing bases, including carbonates, present in the sample is fund by treating it with a known excess of standardized hydrochloric acid. The sample and acid are heated to ensure that the reaction goes to completion. The calcium carbonate equivalent of the sample is obtained by determining the amount of unconsumed acid by titration with standardized sodium hydroxide (Jackson, 1958).

#### **2.0 NOTES AND PRECAUTIONS**

- 2.1 A fizz rating of each sample is used to estimate the neutralization potential and to ensure the addition of sufficient acid to react all the calcium carbonate present.
- 2.2 During the digestion of the sample for neutralization potential, DO NOT BOIL the samples. If boiling occurs, discard sample. Re-run.
- 2.3 Standard precaution for handling concentrated acids and bases is required.

### 3.0 MATERIALS

- 3.1 250 ml beakers
- 3.2 Stir plate and stir bars
- 3.3 Hot plate
- 3.4 50 ml buret
- 3.5 pH meter and calibration buffers

### 4.0 REAGENTS AND PROCEDURE

#### 4.1 Reagents

- 4.1.1 Sulfuric Acid: 0.02N
- 4.1.2 Sodium Hydroxide (NaOH), approximately 0.5N: Dissolve 20.0 grams NaOH pellets in 800 mL Millipore water. Dilute to 1000 ml in a volumetric flask. *Caution: Heat is generated in the preparation of NaOH solutions.*
- 4.1.3 Standardize the NaOH solution by placing 50 ml of 0.02N Sulfuric Acid in a beaker. Titrate with the prepared 0.5N NaOH (4.1.2) to phenolphthalein endpoint. Calculate the normality of the NaOH as follows:

$$N_2 = (N_1 \cdot V_1) / V_2, \text{ where}$$

V<sub>1</sub> = Volume of Sulfuric Acid used (4.1.1)  
N<sub>1</sub> = Normality of Sulfuric Acid used (4.1.1)  
V<sub>2</sub> = Volume of NaOH used (4.1.2)  
N<sub>2</sub> = Calculated Normality of NaOH (4.1.2)

- 4.1.4 Hydrochloric acid (HCL), approximately 0.5N: Dilute 42 ml concentrated HCL to a volume of 1 liter with millipore water.
- 4.1.5 Standardize the Hydrochloric Acid solution by placing 20 ml of the known Normality NaOH (4.1.2) in a beaker. Add 2 to 3 drops phenolphthalein. Titrate with the prepared HCL solution (4.1.4) to a phenolphthalein endpoint. Calculate the Normality of the HCL as follows:

$$N_1 = (N_2 \cdot V_2) / V_1, \text{ where}$$

V<sub>2</sub> = Volume of NaOH used (4.1.5)  
N<sub>2</sub> = Normality of NaOH used (4.1.3)  
V<sub>1</sub> = Volume of HCL used (4.1.4)  
N<sub>1</sub> = Calculated Normality of HCL

4.1.6 Phenolphthalein indicator: Dissolve 0.08 grams phenolphthalein in 100 ml absolute methanol.

#### 4.2 Procedure

4.2.1 Weigh 5.00 grams of sample (less than 100 mesh) into a 250 ml beaker.

4.2.2 Add carefully 50.0 ml 0.5N HCL (4.1.5) to the samples.

4.2.3 Heat on a hot plate at 250° C for 10 minutes, swirling beaker every 5 minutes. Note: The reaction is complete when no gas evolution is visible and particles settle evenly over the bottom of the flask. Let cool.

4.2.4 Calibrate the pH meter according to the pH manual.

4.2.5 Set cooled sample on the stir plate with the stir bar in the sample. Insert the pH probe, keeping the stir bar from hitting the probe.

4.2.6 The pH of the solution should read less than 1.0. If the pH is less than 1.0, proceed with step 4.2.7. If the pH is greater than 1.0, repeat 4.2.1 through 4.2.3, doubling the amount of HCL used (4.1.5). A blank, equal to the amount of acid used, is needed.

4.2.7 Titrate the sample using the 0.5N NaOH (4.1.2) to pH of 7.0.

4.2.8 Run a blank by titrating 50 ml (or appropriate volume) 0.5N HCL (4.1.5) with 0.5N NaOH (4.1.2).

## 5.0 CALCULATIONS

5.1 Neutralization Potential, Tons CaCO<sub>3</sub>/1000 Tons Soil =

(B - V) x N x 50/sample wt (grams), where

B = Volume of NaOH (4.1.2) blank titration

V = Volume of NaOH (4.1.2) sample titration

N = Normality of NaOH (4.1.3)

5.2 Lime as CaCO<sub>3</sub>, % = Neutralization Potential/10

## 6.0 QUALITY ASSURANCE/QUALITY CONTROL

6.1 Duplicates: Every lot of samples and every sample login # ending in zero. Advisory limits are ± 20% RPD.

6.2 Control Soil: Results within established parameters.

## **7.0 ATTACHMENTS**

Attachment A: Record of Acknowledgment

# **STANDARD OPERATING PROCEDURE**

## **ACID POTENTIAL**

### **APPROVED BY:**

Originator	Date
Technical Reviewer (if applicable)	Date
ELI Quality Assurance Officer	Date
ELI Laboratory Manager	Date

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Soils Laboratory

### **1.0 SCOPE AND APPLICATION**

- 1.1 The sample is leached with hot water to remove soluble forms of sulfur.
- 1.2 The sulfur content of the leached sample is then used to calculate the acid potential.

### **2.0 NOTES AND PRECAUTIONS**

- 2.1 During the leaching and filtering step, be careful not to lose any sample by runover, splashing, or breaking through the filter paper.
- 2.2 When folding filter papers for the leaching steps, take care not to sharply crease the filter.
- 2.3 All lab technicians using this method should be familiar with the LECO sulfur determinator and its operator manual.

### 3.0 MATERIALS AND PROCEDURES

#### 3.1 Materials

- 3.1.1 Whatman #41 Filter paper, 15.0 cm
- 3.1.2 Filter rack and funnels
- 3.1.3 LECO Sulfur Determinator SC132
- 3.1.4 Hot plate
- 3.1.5 1 ounce solo cups

#### 3.2 Procedure

- 3.2.1 Heat deionized water to boiling on a hot plate or in a microwave. A restaurant glass coffee pot and a hot plate work well.
- 3.2.2 Place approximately one gram of sample (about 1/4 teaspoon) in a filter (labeled with the lab number) and place in the filter rack. Place the rack in a sink or other suitable pan which can receive the outflow from the funnel.
- 3.2.3 Add boiling water to almost the top of the filter paper. Caution: During this step, be careful not to lose any sample by runover, splashing, or breaking through of the filter.
- 3.2.4 Repeat step 4.2.3 until a total of approximately 150 ml of hot water has been added. Usually three complete washes of hot water are sufficient.
- 3.2.5 Wash the sample down with approximately 150 ml room temperature deionized water.
- 3.2.6 Air-dry the sample and filter overnight.
- 3.2.7 Carefully transfer the sample to a one ounce solo cup and run on the LECO. Any clumps formed after drying the washed sample must be broken up and mixed so the sample is uniform. Analyze the dry homogenized sample with the LECO Sulfur Furnace.
- 3.2.8 The result determined from the LECO is the non-sulfate sulfur percent.

### 5.0 CALCULATIONS

$$5.1 \text{ Acid Potential, meq/100g} = \text{Non-sulfate sulfur, \%} \times 62.5$$

$$5.2 \text{ Acid Potential, TCaCO}_3/1000T = \frac{\text{Acid Potential, meq/100g}}{2}$$

## **6.0 QUALITY ASSURANCE/QUALITY CONTROL**

- 6.1 Duplicates: Every lot of samples and every sample login # ending in zero. Advisory limits are +/- 20% RPD.
- 6.2 Control Soil: Results within established parameters.

## **7.0 REFERENCES**

- 7.1 EPA-600/2-78-054. Field and Laboratory Methods Applicable to Overburden and Minesoils. Industrial Environmental Research Laboratory, Office of Research and Development, U.S. EPA, Cincinnati.
- 7.2 EPA-670/2-74-070. Mine Spoil Potentials for Soil and Water Quality. National Environmental Research Center, Office of Research and Development, U.S. EPA, Cincinnati.
- 7.3 Operating manual and SOP-ELI-40-025 for LECO Sulfur Furnace.

## **8.0 ATTACHMENTS**

Attachment A: Record of Acknowledgment

Attachment B: Control Soil Data Page

# **STANDARD OPERATING PROCEDURE**

## **ACID-BASE POTENTIAL**

### **APPROVED BY:**

Originator	Date
Technical Reviewer (if applicable)	Date
ELI Quality Assurance Officer	Date
ELI Laboratory Manager	Date

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Soils Laboratory

## **1.0 SCOPE AND APPLICATION**

- 1.1 Acid-base accounting is a dependable criterion by which overburden materials can be evaluated. An acid-base account consists of two measurements: (1) total or non-sulfate sulfur and (2) neutralization potential. The accounting balances maximum potential acidity against total neutralizers.
- 1.2 From the modified acid-base account, potentially toxic material is defined as any rock or earth material having a net potential deficiency of 5.0 tons or more of calcium carbonate equivalent per 1000 tons of material. In addition it takes into account the presence of some of the acid-forming sulfate minerals likely to be present in our mine waste samples.

## **2.0 SUMMARY**

- 2.1 Acid-base potential is calculated from acid potential and neutralization potential. A positive result indicates an excess of lime, a negative result indicates a potential lime deficiency.

### **3.0 CALCULATIONS**

3.1 Acid-Base Potential, Tons CaCO<sub>3</sub>/1000 Tons Material =

Neutralization Potential (Tons CaCO<sub>3</sub>/1000 Tons) -

Acid Potential (Tons CaCO<sub>3</sub>/1000 Tons)

### **4.0 QUALITY ASSURANCE/QUALITY CONTROL**

- 4.1 Duplicates: Every lot of samples and every sample login # ending in zero. Advisory limits are +/- 20% RPD.
- 4.2 Control Soil: Every lot or batch of samples analyzed. QC limits within established parameters.

### **5.0 REFERENCES**

- 5.1 EPA-600/2-78-054. Field and Laboratory Methods Applicable to Overburden and Minesoils. Industrial Environmental Research Laboratory, Office of Research and Development, U.S. EPA, Cincinnati.
- 5.2 EPA-670/2-74-070. Mine Spoils Potentials for Soil and Water Quality. National Environmental Research Center, Office of Research and Development, U.S. EPA, Cincinnati.
- 5.3 ELI SOP 50-104-00 for Neutralization Potential.
- 5.4 ELI SOP 50-100-00 for Acid Potential.

### **6.0 ATTACHMENTS**

- 6.1 Attachment A: Record of Acknowledgment
- 6.2 Control Soil Parameters

# **STANDARD OPERATING PROCEDURE**

## **FORMS OF SULFUR**

### **APPROVED BY:**

Originator	Date
Technical Reviewer (if applicable)	Date
ELI Quality Assurance Officer	Date
ELI Laboratory Manager	Date

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## **1.0 SCOPE AND APPLICATION**

The non water-soluble sulfur content of a soil or rock is used to calculate the maximum potential acidity of the sample. When part of the sulfur occurs in non-acid producing forms, the maximum potential acidity, as calculated, will be excessively high. These calculations are referred to as maximums. In doubtful cases, appropriate acid and water leachings should be made to quantify those forms of sulfur which do not produce acid upon oxidation.

## **2.0 NOTES AND PRECAUTIONS**

- 2.1 During the leaching and filtering steps, be careful not to lose any sample by runover, splashing, or breaking through the filter paper.
- 2.2 When folding filter paper for the leaching steps, do not crease the filters sharply.
- 2.3 When dealing with acids, all appropriate safety precautions should be observed.
- 2.4 All lab technicians using this method should be familiar with the LECO sulfur determinator and its manual.
- 2.5 A high lime ( $\text{CaCO}_3$ ) content may affect the results of the sulfur percentage. A corrective measure is needed when high lime samples are encountered. See 6.0.

- 2.6 Some clients request a hot HCL wash in place of the hot water wash and the cold HCL wash. Run these the same as the HNO<sub>3</sub> extraction using the 2+3 HCL instead of 1+7 HNO<sub>3</sub>

### 3.0 MATERIALS AND REAGENTS

#### 3.1 Materials

- 3.1.1 Whatman #41 Filter paper, 15.0 cm.
- 3.1.2 Filter Rack and Funnels
- 3.1.3 LECO Sulfur Determinator SC132
- 3.1.4 100ml beakers and watch glasses
- 3.1.5 Hot plate
- 3.1.6 1 oz solo cups

#### 3.2 Reagents

- 3.2.1 2:3 Hydrochloric Acid (HCL): 2 parts acid to 3 parts water; Mix 400 ml concentrated HCL with 600 ml deionized water.
- 3.2.2 1+7 Nitric Acid (HNO<sub>3</sub>): 1 part acid plus 7 parts water; Mix 125 ml concentrated HNO<sub>3</sub> with 875 ml deionized water.

### 4.0 PROCEDURES

#### 4.1 Total Sulfur

- 4.1.1 Standardize the LECO (3.1.3) to report percentage of sulfur per operator manual instructions. Use the COD standard ( $0.41 \pm 0.02$  or equivalent) for calibration.
- 4.1.2 Weight a sample (less than 100 mesh) between 0.245 - 0.255 grams on the LECO (3.1.3) scale. Press ENTER. Analyze the sample according to the operating manual of the LECO (3.1.3).
- 4.1.3 Record the answer determined by the furnace as "Total Sulfur" in the Sulfur Form Laboratory Notebook.
- 4.1.4 Place the Lab Number of the samples on three filters using ink pens only. Write H<sub>2</sub>O, HCl, and HNO<sub>3</sub> on the filters, with H<sub>2</sub>O on the first one, HCl on the second one, and HNO<sub>3</sub> on the third one. Number the one-ounce solo cups, respectively, using a different color of ink for each wash.

#### 4.2 Hot Water Extractable Sulfur

- 4.2.1 Heat deionized water to boiling on a hot plate or in a microwave. A restaurant style glass coffee pot or a hot plate works well.
- 4.2.2 Place approximately one gram of sample (about 1/4 teaspoon) in a filter. Place on the filter rack. Place the rack in a sink or other suitable pan which can receive the outflow from the funnel.

- 4.2.3 Add near-boiling, deionized water to almost the top of the filter paper. CAUTION: During this step and all other leaching steps, be careful not to lose any sample by runover, splashing, or breaking through the filter paper
- 4.2.4 Repeat step 4.2.3 until a total of approximately 150 ml of hot water has been added. Usually, three complete washes of hot water are sufficient.
- 4.2.5 Wash the sample down the approximately 150 ml of room temperature deionized water.
- 4.2.6 Air-dry the sample. Filter overnight.
- 4.2.7 Carefully transfer the sample to a one-ounce solo cup. Any clumps formed after drying the washed sample, must be broken up and mixed until uniform. Analyze the dry, homogenized sample with the LECO Sulfur Furnace (4.1.1 and 4.1.2).
- 4.2.8 Calculate the hot water extractable sulfur (5.1). Record in the Sulfur Form Laboratory notebook. The answer should be equal to or less than the Total Sulfur (4.1).

#### 4.3 HCL Extractable Sulfur

- 4.3.1 Follow step 4.2.2 using a new sample.
- 4.3.2 Add 2:3 HCL to almost the top of the funnel. CAUTION: During the leaching and filtering steps, be careful not to lose any sample by runover, splashing, or breaking through the filter paper.
- 4.3.3 Repeat step 4.3.2 three times until approximately 150 ml have been added.
- 4.3.4 After the final rinse (4.3.3), wash the sample with approximately 200 ms deionized water.
- 4.3.5 Repeat steps 4.2.6 - 4.2.7. Calculate he HC1 extractable sulfur (5.2). Record in the Sulfur Form Laboratory Notebook. The HC1 extractable sulfur should be less than or equal to the Hot Water Extractable Sulfur.

#### 4.4 HNO<sub>3</sub> Extractable Sulfur

- 4.4.1 Place approximately one gram of sample (less than 100 mesh) in a 150 ml beaker. Add 50 ml 1+7 HNO<sub>3</sub>(3.2.2). Place on a hot plate. Heat to near boiling. Continue digesting for six hours.
- 4.4.2 Let cool overnight.
- 4.4.3 Filter. Rinse the sample with approximately 200 ml water.
- 4.4.4 Repeat steps 4.2.6 - 4.2.7. Calculate the HNO<sub>3</sub> extractable sulfur. Record in the Sulfur Form Laboratory Notebook. The HNO<sub>3</sub> should be less than the HC1 extractable sulfur.

### 5.0 CALCULATIONS

- 5.1 Hot Water Extractable Sulfur, %(mostly sulfates) = (Total Sulfur of untreated sample) minus (Total Sulfur after Hot water leach)
- 5.2 HCL Extractable Sulfur, % (acid dissociable sulfides and less soluble sulfates) = (Total sulfur after-water leach) minus (Total Sulfur after-HCL treatment).
- 5.3 HNO<sub>3</sub> Extractable Sulfur, % (mostly pyrite or other acid-forming sulfides) = (Total Sulfur after HCL leach) minus (Total Sulfur after HNO<sub>3</sub> treatment).

- 5.4 Residual Sulfur, % (mostly organic sulfur: NOTE: should be near zero) = Total Sulfur after HNO<sub>3</sub> treatment.

## 6.0 CORRECTING SULFUR FORM DATA FOR LOSS OF ACID SOLUBLES

- 6.1 During the washing of soil samples for determining sulfur forms, a substantial amount of the sample can be dissolved due to a high CaCO<sub>3</sub> content. This results in an erroneously high sulfur percentage when testing the washed sample. To correct this, observe which samples have high lime. Weigh each sample plus the respective filter before and after the washing steps.

- 6.2 Correct for the amount of sample dissolved as follows:

$$\% \text{ Sulfur Corrected} = \% \text{ Sulfur Uncorrected} (1 - \text{decimal \% loss})$$

Example:

Sample Weight before washing = 2.3211

Sample Weight after washing = 1.6922

Difference = 0.6289

$$\% \text{ Loss} = 27.09 = \frac{\text{Difference in Weight}}{\text{Sample Weight before Wash}}$$

$$\text{Decimal \% Loss} (\% \text{ loss}/100) = 0.27$$

$$\% \text{ Sulfur uncorrected} = 2.78$$

$$\text{Then: } 2.78 (1 - 0.27) = 2.03$$

## 7.0 QUALITY ASSURANCE/QUALITY CONTROL

- 7.1 Duplicates - Every lot of samples and every sample login # ending in zero. Advisory limits are  $\pm$  20% RPD.

- 7.2 Control Soil - Results within established parameters.

## 8.0 REFERENCES

- 8.1 EPA-670/2-74-070. Mine Spoil Potentials for Soil and Water Quality. National Environmental Research Center, Office of Research and Development, U.S. EPA, Cincinnati.

- 8.2 EPA-600/2-78-054. Field and Laboratory Methods Applicable to Overburden and Minesoils. Industrial Environmental Research Laboratory, Office of Research and Development, U.S. EPA, Cincinnati.

## 9.0 ATTACHMENTS

Attachment A - Record of Acknowledgment

**APPENDIX H**  
**Revised April 4, 1996**

**TESTING RESULTS - ABA, METALS, GRAIN SIZE**

## **LIST OF TABLES**

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Table H.1 Static Test Results - New Core Sample (NP, AP, ABA, units are tons CaCO<sub>3</sub>/ktons)

Sample ID	Depth	Sample Collection Date	Sample Analysis Date	NP	AP	ABA	Lime, % as CaCO <sub>3</sub>	Total Sulfur %	Hot H <sub>2</sub> O Extractable Sulfur %	HCl Extractable Sulfur %	HNO <sub>3</sub> Extract Sulfur %	Residual Sulfur, %	Paste pH	Percent Retained by:			
														60	100	200	400
E5B301	10	12/12/93	12/7/94	14	9.4	4.6	1.4	0.37	0.06	0.01	0.3	<0.01	7.9	3.9	14.2	28	34.6
E5B301	15	12/12/93	12/7/94	18	7.2	10.8	1.8	0.35	0.02	0.05	0.23	0.05	7.8	4.2	17	29.5	30.7
E5B301	20	12/12/93	12/7/94	18	12	6	1.8	0.64	0.11	0.1	0.39	0.04	7.7	7	22.9	28.3	22.7
E5B301	40	12/12/93	12/7/94	23	27	-4	2.3	1.13	0.08	0.13	0.87	0.05	7.7	3.7	16.5	30.2	25.4
E5B301	50	12/12/93	12/7/94	34	21	13	3.4	0.86	0.11	0.01	0.67	0.07	7.7	0.2	0.5	6.1	8.3
E5B301	60	12/12/93	12/7/94	25	27	-2.0	2.5	1.02	0.12	<0.01	0.86	0.04	7.7	0.2	1.4	11.5	25.3
E5B301	90	12/12/93	12/7/94	18	32	-14	1.8	1.14	0.01	0.07	1.01	0.05	7.6	0.2	0.7	3.8	15.5
E5B301	100	12/12/93	12/7/94	8	30	-22	0.8	1.12	<0.01	0.13	0.95	0.04	7.8	5.1	19.7	26.7	18
E5B301	130	12/12/93	12/7/94	7	11	-4	0.7	0.43	0.06	<0.01	0.35	0.02	7.9	0.05	0.05	17	20.7
E5B301	140	12/12/93	12/7/94	3	12.5	-9.5	0.3	0.49	0.06	0.03	0.4	<0.01	7.9	0.2	2.8	28.1	36.5
E5B301	150	12/12/93	12/7/94	7	15.6	-8.6	0.7	0.59	0.01	0.08	0.5	<0.01	8	0.3	4	22.6	29.4
E5B301	160	12/12/93	12/7/94	9	16.2	-7.2	0.9	0.64	0.03	0.05	0.52	0.04	8	0.9	6.7	22.3	27.3
E7B303	30	12/2/93	12/7/94	24	13	11	2.4	0.52	0.07	<0.01	0.41	0.04	7.8	5.3	16.9	28.4	23.3
E7B303	40	12/2/93	12/7/94	18	22.5	-4.5	1.8	0.83	0.02	0.04	0.72	0.05	7.8	3.2	13	28.9	24.6
E7B303	50	12/2/93	12/7/94	32	29.1	2.9	3.2	1.23	0.23	<0.01	0.93	0.07	7.7	1.4	8	20.6	20.6
E7B303	60	12/2/93	12/7/94	28	31.2	-3.2	2.8	1.25	0.16	<0.01	1	0.09	7.7	2.6	8.2	22.5	23.7
E7B303	70	12/2/93	12/7/94	26	25	1.0	2.6	0.96	0.13	<0.01	0.8	0.03	7.7	0.5	1.3	6.8	12.2
E7B303	80	12/2/93	12/7/94	24	24.38	-0.38	2.4	0.9	0.08	<0.01	0.78	0.04	7.8	0.5	2.6	8.3	12
E7B303	90	12/2/93	12/7/94	23	26.9	-3.9	2.3	0.99	0.1	<0.01	0.86	0.03	7.9	0.1	1	5.8	13.3
E7B303	100	12/2/93	12/7/94	23	20.9	2.1	2.3	0.83	0.1	0.01	0.67	0.05	7.8	1.3	3.4	6	5.3
E7B303	120	12/2/93	12/7/94	11	10.9	0.1	1.1	0.42	0.05	<0.01	0.35	0.02	7.9	0.3	2.1	5.7	9
E7B303	130	12/2/93	12/7/94	15	11.2	3.8	1.5	0.45	0.05	0.02	0.36	0.02	8	0.1	4	5.5	7.2
E7B303	150	12/2/93	12/7/94	9	14.4	-5.4	0.9	0.52	0.06	<0.01	0.46	<0.01	8.1	0.1	0.3	5.7	18.5
E7B303	170	12/2/93	12/7/94	8	14.4	-6.4	0.8	0.52	0.06	<0.01	0.46	<0.01	8.1	0	1.2	10.4	16.9

Table H.1 (continued)

Static Test Results - New Core Sample (NP, AP, ABA, units are tons CaCO<sub>3</sub>/ktons)

Sample ID	Depth	Sample Collection Date	Sample Analysis Date	NP	AP	ABA	Lime, % as CaCO <sub>3</sub>	Total Sulfur %	Hot H <sub>2</sub> O Extractable Sulfur %	HCl Extractable Sulfur %	HNO <sub>3</sub> Extract Sulfur %	Residual Sulfur, %	Paste pH	Percent Retained by:			
														60	100	200	400
W4A307	5	12/29/93	12/7/94	42	32.2	9.8	4.2	1.25	0.03	0.1	1.03	0.09	7.9	9.1	16.1	27.7	20
W4A307	10	12/29/93	12/7/94	23	21.9	1.1	2.3	0.9	0.12	0.03	0.7	0.05	7.9	4.5	17	30.3	21.8
W4A307	15	12/29/93	12/7/94	28	22.2	5.8	2.8	0.79	<0.01	0.05	0.71	0.03	7.9	3	14.7	27.5	24.5
W4A307	20	12/29/93	12/7/94	21	17.2	3.8	2.1	0.62	0.05	<0.01	0.55	0.02	7.9	2.4	15.1	29.6	23.9
W4A307	30	12/29/93	12/7/94	27	22.2	4.8	2.7	0.9	0.14	<0.01	0.71	0.05	7.9	2	10.9	34.2	24.7
W4A307	40	12/29/93	12/7/94	27	36.9	-9.9	2.7	1.29	<0.01	0.06	1.18	0.05	8	3.5	19.3	36.1	21
W4A307	70	12/29/93	12/7/94	32	29.4	2.6	3.2	1.12	0.14	<0.01	0.94	0.04	8	0.1	0.6	3	11.1
W4A307	80	12/29/93	12/7/94	25	24.4	0.6	2.5	0.92	0.13	<0.01	0.78	0.01	7.9	0.2	3.1	14.4	20.7
W4A307	90	12/29/93	12/7/94	20	23.4	-3.4	2	0.85	0.07	<0.01	0.75	0.03	8	0.1	0.2	1.6	9.2
W4A307	100	12/29/93	12/7/94	11	28	-17	1.1	0.97	0.07	<0.01	0.9	<0.01	8	0.3	2.9	19.1	22.2
W4A307	110	12/29/93	12/7/94	13	19.4	-6.4	1.3	0.69	0.06	<0.01	0.62	0.01	8	0.1	0.6	3.2	11.3
W4A307	120	12/29/93	12/7/94	11	10.9	0.1	1.1	0.4	0.05	<0.01	0.35	<0.01	8	0.1	1.2	10	17.7
W4A307	130	12/29/93	12/7/94	10	10.3	-0.3	1	0.41	0.08	<0.01	0.33	<0.01	8	0.6	2.1	13.5	18.9
W4A307	150	12/29/93	12/7/94	7	14.7	-7.7	0.7	0.53	0.06	<0.01	0.47	<0.01	8.1	0.9	6	17	20.2
W4A307	160	12/29/93	12/7/94	7	13.4	-6.4	0.7	0.48	0.05	<0.01	0.43	<0.01	8.1	0.5	5.1	17.9	20.3
W4A307	170	12/29/93	12/7/94	4	16	-12	0.4	0.61	0.08	<0.01	0.51	0.02	8.2	0.8	9.1	22.4	23
W6A105	15	2/9/94	12/7/94	78	45	33	7.8	1.8	0.23	0.02	1.43	0.12	8	11.8	24.3	29.4	13.2
W6A105	30	2/9/94	12/7/94	11	11.6	-0.6	1.1	0.38	0.01	<0.01	0.37	<0.01	7.9	0.6	5.8	24.1	30.9
W6A105	40	2/9/94	12/7/94	9	13.4	-4.4	0.9	0.51	0.08	<0.01	0.43	<0.01	8.2	0.3	5.2	28	31.5
W6A105	50	2/9/94	12/7/94	9	11.6	-2.6	0.9	0.48	0.07	0.04	0.37	<0.01	8.2	0.7	2.3	18.7	19.6
W6A105	60	2/9/94	12/7/94	11	15	-4	1.1	0.58	0.09	0.01	0.48	<0.01	7.9	0.3	1	10.9	20.7
W6A105	80	2/9/94	12/7/94	12	13.1	-1.1	1.2	0.51	0.06	0.02	0.42	0.01	8.1	0.6	4.1	12.2	16.7
W6A105	90	2/9/94	12/7/94	5	21	-16	0.5	0.75	0.07	0.01	0.67	<0.01	6.9	0.1	1.9	11.7	23.7
W6A105	100	2/9/94	12/7/94	4	3.8	0.2	0.4	0.18	0.06	<0.01	0.12	<0.01	7.3	0.3	4.4	20.4	22.6
W6A105	110	2/9/94	12/7/94	-	-	-	39.5	0.08	0.08	<0.01	<0.01		7.8	13	13.3	5.7	5.8

Table H.1 (continued)

Static Test Results - New Core Sample (NP, AP, ABA, units are tons CaCO<sub>3</sub>/ktons)

Sample ID	Depth	Sample Collection Date	Sample Analysis Date	NP	AP	ABA	Lime, % as CaCO <sub>3</sub>	Total Sulfur %	Hot H <sub>2</sub> O Extractable Sulfur %	HCl Extractable Sulfur %	HNO <sub>3</sub> Extract Sulfur %	Residual Sulfur, %	Paste pH	Percent Retained by:			
														60	100	200	400
W10B	100	3/30/94	12/7/94	28	23.1	4.9	2.8	0.93	0.12	0.01	0.74	0.06	7.9	0.1	0.9	21.5	39.5
W10B	110	3/30/94	12/7/94	22	29.1	-7.1	2.2	1.11	0.11	0.05	0.93	0.02	8	0.1	1.9	22.8	35.8
W10B	120	3/30/94	12/7/94	14	19.1	-5.1	1.4	0.69	0.08	<0.01	0.61	<0.01	8.3	0.1	3.4	32.3	34.1
W10B	130	3/30/94	12/7/94	12	13.1	-1.1	1.2	0.5	<0.01	0.06	0.42	0.02	8.1	1	8.3	14.7	18.5
W10B	140	3/30/94	12/7/94	10	10	0	1	0.39	0.04	0.03	0.32	<0.01	8.3	0.1	0.6	20.9	36.1
W10B	150	3/30/94	12/7/94	9	11.2	-2.2	0.9	0.44	0.08	<0.01	0.36	<0.01	8.2	0.1	2.6	20.2	26.5
W10B	160	3/31/94	12/7/94	8	16.2	-8.2	0.8	0.57	0.05	<0.01	0.52	<0.01	8.3	0.3	12.1	43.4	25.4
W10B	170	3/31/94	12/7/94	12	15	-3	1.2	0.55	0.07	<0.01	0.48	<0.01	8.2	0.1	1.6	17.9	34.2
W10B	180	3/31/94	12/7/94	9	14.4	-5.4	0.9	0.56	0.1	<0.01	0.46	<0.01	8	0.1	0.3	4.7	17.5
W10B	190	3/31/94	12/7/94	4	21.2	-17.2	0.4	0.78	0.07	0.03	0.68	<0.01	8.4	1	14.3	33.3	25.4
W3B	20	3/28/94	12/7/94	13	12.8	0.2	1.3	0.54	0.07	<0.01	0.41	0.06	7.9	20.9	19.5	22.7	14.5
W3B	30	3/28/94	12/7/94	11	18.4	-7.4	1.1	0.89	0.14	0.02	0.59	0.14	7.8	5.2	14.7	25.7	20.5
W3B	40	3/28/94	12/7/94	18	57	-39	1.8	2.36	0.4	<0.01	1.82	0.14	8	31.8	34	21.4	5.6
W3B	50	3/28/94	12/7/94	11	32	-21	1.1	1.42	<0.01	0.36	1.01	0.05	8.2	10.2	20	24.9	14.4
W3B	60	3/28/94	12/7/94	12	32	-20	1.2	1.36	0.27	<0.01	1.01	0.08	7.9	3.3	12.9	19	13.4
W3B	100	3/28/94	12/7/94	3	18	-15	0.3	0.6	<0.01	<0.01	0.59	0.01	8.2	4.3	17.9	31.1	21.5
W3B	140	3/28/94	12/7/94	1	15	-14	0.1	0.63	0.14	<0.01	0.49	<0.01	8	29	29.8	23.3	8.5

Table H.2 Static Test Results - Archived Core Sample (NP, AP, ABA, units are tons CaCO<sub>3</sub>/ktons)

Sample ID	Depth	Sample Collection Date	Sample Analysis Date	NP	AP	ABA	Lime % as CaCO <sub>3</sub>	Total Sulfur %	Hot H <sub>2</sub> O Extractable Sulfur %	HCl Extractable Sulfur %	HNO <sub>3</sub> Extract Sulfur %	Residual Sulfur, %	Paste pH	Percent Retained by:			
														60	100	200	400
NETL-449D	43.8	10/24/91	12/7/94	15	21.2	-6.2	1.5	0.86	0.05	0.1	0.68	0.03	7.8	1.2	11.9	35.9	23.2
NETL-449D	49	10/24/91	12/7/94	14	31	-17	1.4	1.18	0.17	<0.01	0.99	0.02	7.8	0.6	2	14.3	28.6
NETL-449D	83.3	10/24/91	12/7/94	6	11.9	-5.9	0.6	0.47	0.01	0.07	0.38	0.01	7.7	1.7	18.8	42.9	19.7
NETL-449D	88.3	10/24/91	12/7/94	9	20	-11	0.9	0.78	0.14	<0.01	0.64	<0.01	7.3	0.3	4.7	36.9	31.5
NETL-449D	89.8	10/24/91	12/7/94	5	22	-17	0.5	0.81	0.04	0.06	0.7	0.01	4.4	3	23	42.9	18.2
NETL-449D	113.0	10/24/91	12/7/94	5	18	-13	0.5	0.7	0.14	<0.01	0.56	<0.01	7.7	0.1	0.8	10.3	35.6
NETL-449D	115.2	10/24/91	12/7/94	2	16	-14	0.2	0.73	0.16	0.07	0.5	<0.01	3.9	1	21.5	44	17.6
NETL-449D	124.3	10/24/91	12/7/94	3	7.2	-4.2	0.3	0.35	0.12	<0.01	0.23	<0.01	7.4	0.4	6.4	39.6	32.5
NETL-449D	125.5	10/24/91	12/7/94	4	11.9	-7.9	0.4	0.55	<0.01	0.15	0.38	0.02	7.2	2.1	32.8	44.7	12.7
NETL-449D	130.1	10/24/91	12/7/94	5	10.9	-5.9	0.5	0.41	0.05	0.01	0.35	<0.01	7.4	0.1	3.5	55.2	11.3
NETL-449D	138.6	10/24/91	12/7/94	3	25	-22	0.3	0.92	0.04	0.05	0.8	0.03	5.9	1.2	18.5	35	15.8
NETL-449D	150.6	10/24/91	12/7/94	5	10	-5	0.5	0.45	0.13	<0.01	0.32	<0.01	7.6	0.3	3.2	39.7	31
NETL-449D	153.4	10/24/91	12/7/94	2	18	-16	0.2	0.79	0.12	0.09	0.58	<0.01	4.4	0.4	6.9	43.2	21.6
NETL-449D	158.3	10/24/91	12/7/94	4	15	-11	0.4	0.75	0.28	<0.01	0.47	<0.01	6.2	0.6	16.5	53.8	18.7
NETL-449D	163.6	10/24/91	12/7/94	5	2.8	2.2	0.5	0.16	0.07	<0.01	0.09	<0.01	7.2	4.4	31.5	39	12.9
DH-MK93	25	12/18/94	12/7/94	13	21.2	-8.2	1.3	0.76	0.03	<0.01	0.68	0.05	8.2	2.8	19.5	37.6	19.6
DH-MK93	35	12/18/94	12/7/94	13	21.6	-8.6	1.3	0.89	0.16	<0.01	0.69	0.04	7.9	8	17.8	26.7	20.3
DH-MK93	130	12/18/94	12/7/94	8	27	-19	0.8	0.92	<0.01	<0.01	0.87	0.05	8	8.4	24	30.6	13.3
DH-MK93	140	12/18/94	12/7/94	8	35	-27	0.8	1.41	0.1	0.11	1.12	0.08	8	16.9	25.1	26.1	12.6
DH91-1072	31.7	10/24/91	12/7/94	2	13	-11	0.6	0.51	0.11	0.02	0.38	<0.01	6	7.8	29.1	36.2	13.9
DH91-1072	36.8	10/24/91	12/7/94	6	11.8	-5.9	0.5	1.43	0.24	0.03	1.12	0.04	6.3	2.1	11.8	35.9	28.4
DH91-1072	41.7	10/24/91	12/7/94	4	13.1	-9.1	0.1	0.57	0.22	0.03	0.3	0.02	3.5	3.8	31.3	34.9	13.7
DH91-1072	48.8	10/24/91	12/7/94	5	35	-30	0.5	0.55	0.08	0.04	0.43	<0.01	3.6	17.7	35.7	27.4	9.8
DH91-1072	62.5	10/24/91	12/7/94	1	9.4	-8.4	0.4	0.58	0.09	0.07	0.42	<0.01	3.7	9	30.6	34.1	11.6
DH91-1072	68.5	10/24/91	12/7/94	5	13.4	-8.4	0.2	1.01	0.23	0.32	0.41	0.05	5	8.7	33.4	34.8	12.1

Table H.3 Static Test Results - Embankment Sample (NP, AP, ABA, units are tons CaCO<sub>3</sub>/ktons)

Sample ID	Depth	Sample Collection Date	Sample Analysis Date	NP	AP	ABA	Lime % as CaCO <sub>3</sub>	Total Sulfur %	Hot H <sub>2</sub> O Extractable Sulfur %	HCl Extractable Sulfur %	HNO <sub>3</sub> Extract Sulfur %	Residual Sulfur %	Paste pH	Percent Retained by:			
														60	100	200	400
S2	6-12	3/18/94	12/7/94	22	10.3	11.7	2.2	0.55	<0.01	0.18	0.33	0.04	7.6	6.6	24.7	31.7	18.0
S4	0-6	3/18/94	12/7/94	18	7.2	10.8	1.8	0.35	0.05	<0.01	0.23	0.07	7.9	1.3	15.8	44.2	21.5
S5	0-6	3/18/94	12/7/94	37	25.6	11.4	3.7	0.96	0.03	<0.01	0.82	0.11	7.8	14.6	24.3	28.4	15.1
S5	0-6	3/18/94	12/7/94	25	15.3	9.7	2.5	0.67	<0.01	0.09	0.49	0.09	7.8	13.4	24.9	29.2	15.6
S6	6-12	3/18/94	12/7/94	15	4.4	10.6	1.5	0.27	0.13	<0.01	0.14	<0.01	7.8	4.4	19.8	33.7	21.4
S7	6-12	3/16/94	12/7/94	7	4.1	2.9	0.7	0.23	0.04	0.01	0.13	0.05	8.2	1.5	18.7	37.4	22.4
S8	0-6	3/16/94	12/7/94	20	24.4	-4.4	2	0.91	<0.01	0.05	0.78	0.08	8.4	14.9	29.3	30.4	13.7
S9	0-6	3/16/94	12/7/94	26	17.5	8.5	2.6	0.68	0.11	<0.01	0.56	0.01	7.6	3.9	27.7	27.8	27.8
S9	6-12	3/16/94	12/7/94	18	7.5	10.5	1.8	0.38	0.14	<0.01	0.24	<0.01	7.8	0.5	6.3	24.8	31.8
S10	6-12	3/16/94	12/7/94	34	39.7	-5.7	3.4	1.43	0.08	<0.01	1.27	0.08	7.9	4	16.8	33.7	23.7
S11	0-6	3/16/94	12/7/94	22	11.6	10.4	2.2	0.54	0.1	0.04	0.37	0.03	7.8	0.6	6.1	28.1	33.3
S12	6-12	3/16/94	12/7/94	36	10.6	25.4	3.6	0.58	<0.01	0.16	0.34	0.08	7.8	8.7	28.6	36.3	14.8
S14	0-6	3/16/94	12/7/94	28	25	3.0	2.8	1.3	0.3	0.14	0.8	0.06	7.4	2.4	16.5	35.7	23.7
S15	6-12	3/16/94	12/7/94	21	15.9	5.1	2.1	0.63	<0.01	0.03	0.51	0.09	8.3	12.5	29.4	31.9	12.8
S15	0-6	3/16/94	12/7/94	13	5.0	8.0	1.3	0.19	0.03	<0.01	0.16	<0.01	8.2	11.7	24.2	26.9	16.6
S16	6-12	3/16/94	12/7/94	24	12.2	11.8	2.4	0.55	0.13	<0.01	0.39	0.03	7.6	6.9	23.3	36.4	18
S16	0-6	3/16/94	12/7/94	49	19	30	4.9	0.73	<0.01	0.04	0.62	0.07	7.5	12.6	21.3	28.3	16.4
S17	6-12	3/16/94	12/7/94	20	5.9	14.1	2	0.29	0.1	<0.01	0.19	<0.01	7.9	4.1	11.7	30	27
S18	6-12	3/16/94	12/7/94	12	7.5	4.5	1.2	0.33	0.06	<0.01	0.24	0.03	7.8	11.8	22.7	27.4	14.9
S19	0-6	3/16/94	12/7/94	14	15.6	-1.6	1.4	0.68	0.1	<0.01	0.5	0.08	7.8	8.6	34	31.1	13.1
S20	6-12	3/16/94	12/7/94	20	13.1	6.9	2	0.55	0.05	<0.01	0.42	0.08	7.9	10.2	35	26.6	11.6
T1L2	6-12	3/16/94	12/7/94	61	13	48	6.1	0.52	0.08	<0.01	0.41	0.03					
T1L2	0-6	3/16/94	12/7/94	16	15.9	0.1	1.6	0.73	0.08	0.07	0.51	0.07					
T1L	6-12	3/16/94	12/7/94	0.5	3.4	-2.9	<0.1	0.45	0.32	0.02	0.11	<0.01	4.8	12.6	32.7	32.3	12
T1L	0-6	3/16/94	12/7/94	4	3.4	0.6	0.4	0.57	0.46	<0.01	0.11	<0.01	4.7	17.1	32.5	28.8	9.8
T2L	6-12	3/16/94	12/7/94	12	10	2.0	1.2	0.8	0.45	<0.01	0.32	0.03	6.7	30.8	18.4	22.9	14.4

Table H.3 (Continued) Static Test Results - Embankment Sample (NP, AP, ABA, units are tons CaCO<sub>3</sub>/ktons)

Sample ID	Depth	Sample Collection Date	Sample Analysis Date	NP	AP	ABA	Lime % as CaCO <sub>3</sub>	Total Sulfur %	Hot H <sub>2</sub> O Extractable Sulfur %	HCl Extractable Sulfur %	HNO <sub>3</sub> Extract Sulfur %	Residual Sulfur %	Paste pH	Percent Retained by:			
														60	100	200	400
T2L	0-6	3/16/94	12/7/94	10	11.6	-1.6	1	0.62	0.21	<0.01	0.37	0.04	6.8	22.9	22.1	31.1	14.4
T3L	6-12	3/16/94	12/7/94	0.5	14	-13.5	<0.1	1.28	0.57	0.25	0.46	<0.01	2.9	21.2	17.1	19.2	14
T3L	0-6	3/16/94	12/7/94	1	10.3	-9.3	0.1	1.04	0.4	0.27	0.33	0.04	2.7	25.3	22	19.6	10.2
T4L	0-6	3/16/94	12/7/94	0.5	11.2	-10.7	<0.1	1.15	0.52	0.24	0.36	0.03	2.9	8.1	15.4	28.3	19.1
T5L	6-12	3/16/94	12/7/94	5	12.2	-7.2	0.5	0.91	0.33	0.19	0.39	<0.01	5.6	32.1	23.7	17.5	8.8
T5L	0-6	3/16/94	12/7/94	89	35	54	8.9	1.32	0.09	<0.01	1.13	0.1	7.6	30.1	22.6	23.9	10.5
T6L	6-12	3/17/94	12/7/94	190	11	179	19	0.43	<0.01	<0.01	0.35	0.08	7.6	31.2	20.6	23.6	9.6
T6L	0-6	3/17/94	12/7/94	183	20	163	18.3	0.75	0.05	<0.01	0.64	0.06	7.6	27.5	20.8	25.5	11.3
T7L	6-12	3/17/94	12/7/94	0.5	4.1	-3.6	<0.1	0.29	0.13	0.01	0.13	0.02	3.5	27.0	29.5	23.8	8.3
T7L	0-6	3/17/94	12/7/94	12	12.5	-0.5	1.2	0.62	0.19	0.02	0.4	0.01	6.7	31.9	25.5	20.6	9.3
T8L	6-12	3/17/94	12/7/94	302	0.16	302	30.2	<0.01	<0.01	<0.01	<0.01	<0.01	7.9	22.7	14.5	34.8	14.5
T8L	0-6	3/17/94	12/7/94	276	0.62	275	27.6	0.02	<0.01	<0.01	0.02	<0.01	8.2	35.2	12.5	30.1	7.0
T9L	6-12	3/17/94	12/7/94	6	1.9	4.1	0.6	0.27	0.18	0.03	0.06	<0.01	4.7	43.5	25.1	15.5	6.0
T10L	0-6	3/17/94	12/7/94	9	11.9	-2.9	0.9	0.59	0.11	0.06	0.38	0.04	5.3	37.5	22.6	19.2	10.0
T11L	6-12	3/17/94	12/7/94	19	26.2	-7.2	1.9	1.33	0.39	<0.01	0.84	0.1	7.8	30.8	23.5	24.1	11.4
T11L	0-6	3/17/94	12/7/94	65	25	40	6.5	1.85	1	<0.01	0.79	0.06	7.7	20.7	22.6	29.3	15.5
T13L	6-12	3/17/94	12/7/94	0.5	38	-37.5	<0.1	2.56	1.08	0.2	1.23	0.05	4.0	12.7	19.3	27.0	11.9
T13L	0-6	3/17/94	12/7/94	5	32	-27	0.5	2.2	0.97	0.14	1.03	0.06	5.7	27.3	21.2	24.1	11.1
T14L	6-12	3/17/94	12/7/94	288	0.16	288	28.8	<0.01	<0.01	<0.01	<0.01	<0.01	7.9	16.2	20.0	28.0	9.7
T15L	6-12	3/17/94	12/7/94	92	1.2	91	9.2	0.94	0.88	<0.01	0.04	0.02	7.6	26.8	23.1	24.6	10.6
T16L	6-12	3/17/94	12/7/94	7	42	-35	0.7	1.71	0.18	0.12	1.35	0.06	7.4	36.7	32.7	20.9	5.8
T16L	0-6	3/17/94	12/7/94	8	29	-21	0.8	1.24	0.27	0.01	0.92	0.04	7.9	24.2	24.9	23.7	12.8
T17L	6-12	3/17/94	12/7/94	31	0.62	30	3.1	0.13	0.11	<0.01	0.02	<0.01	7.8	13.3	21.6	29.8	17.7
T17L	0-6	3/17/94	12/7/94	37	1.9	35.1	3.7	3.19	2.42	0.69	0.06	0.02	7.5	12.3	21.7	35.6	17.0
T18L	6-12	3/18/94	12/7/94	9	7.2	1.8	0.9	0.5	0.27	<0.01	0.23	<0.01	7.6	8.0	27.0	51.6	11.1
T18L	0-6	3/18/94	12/7/94	13	10.3	2.7	1.3	0.41	0.02	0.06	0.33	<0.01	7.7	5.1	33.4	49.2	8.6
T19L	6-12	3/18/94	12/7/94	18	15.6	2.4	1.8	0.79	0.22	0.03	0.5	0.04	7.7	23.0	26.5	25.8	13.3

Table H.3 (Continued) Static Test Results - Embankment Sample (NP, AP, ABA, units are tons CaCO<sub>3</sub>/ktons)

Sample ID	Depth	Sample Collection Date	Sample Analysis Date	NP	AP	ABA	Lime % as CaCO <sub>3</sub>	Total Sulfur %	Hot H <sub>2</sub> O Extractable Sulfur %	HCl Extractable Sulfur %	HNO <sub>3</sub> Extract Sulfur %	Residual Sulfur, %	Paste pH	Percent Retained by:			
														60	100	200	400
T19L	0-6	3/18/94	12/7/94	27	34.1	-7.1	2.7	2.16	0.99	0.02	1.09	0.06	7.7	18.0	22.2	30.5	14.7
T20L	6-12	3/18/94	12/7/94	17	34	-17	1.7	1.53	0.38	<0.01	1.09	0.06	7.7	11.0	20.2	34.6	19.2
T21L	0-6	3/18/94	12/7/94	13	27	-14	1.3	2.32	1.22	0.18	0.87	0.05	7.4	15.1	17.6	27.1	19.7
T22L	6-12	3/18/94	12/7/94	13	32	-19	1.3	1.67	0.5	0.09	1.01	0.07	7.5	20.6	21.0	26.4	14.5
T22L	0-6	3/18/94	12/7/94	7	10.6	-3.6	0.7	1.17	0.54	0.26	0.34	0.03	7.8	28.0	23.0	22.7	12.1
T1M	6-12	3/16/94	12/7/94	48	14	34	4.8	1.66	1.15	0.07	0.44	<0.01					
T2M	6-12	3/16/94	12/7/94	0.5	10	-9.5	<0.1	1.22	0.73	0.15	0.32	0.02	3.1	29	20.4	20.9	10.6
T2M	0-6	3/16/94	12/7/94	0.5	9.7	-9.2	<0.1	1.16	0.71	0.14	0.31	<0.01	3.4	24.4	20.3	22.1	12.2
T3M	6-12	3/16/94	12/7/94	5	9.1	-4.1	0.5	0.99	0.66	0.04	0.29	<0.01	3.4	7.2	11.3	22.7	21.5
T3M	0-6	3/16/94	12/7/94	8	28	-20	0.8	1.3	0.06	0.28	0.9	0.06	6.6	12.8	15.5	24.5	18.2
T4M	6-12	3/16/94	12/7/94	6	9.4	-3.4	0.6	1.18	0.62	0.19	0.3	0.07	2.8	29.3	23.1	22.2	9.8
T4M	0-6	3/16/94	12/7/94	20	42.5	-22.5	2	1.76	0.02	0.23	1.36	0.15	3.8	27.1	18.6	22.4	12.4
T5M	0-6	3/16/94	12/7/94	60	65.6	-5.6	6	2.36	0.14	<0.01	2.1	0.12	7.5	27.4	28.7	27.6	8.6
T6M	6-12	3/17/94	12/7/94	205	2.5	202.5	20.5	0.14	<0.01	<0.01	0.08	0.06	7.6	25.1	17.8	25.8	12.1
T6M	0-6	3/17/94	12/7/94	168	11	157	16.8	0.71	0.26	<0.01	0.37	0.08	7.5	24.2	18.8	27.0	12.5
T7U	6-12	3/17/94	12/7/94	3	10.3	-7.3	0.3	0.85	0.39	0.07	0.33	0.06	3.9	25.0	24.6	22.5	9.9
T7U	0-6	3/17/94	12/7/94	6	26	-20	0.6	1.83	0.76	0.17	0.82	0.08	6.1	25.7	24.5	24.1	10.6
T8U	6-12	3/17/94	12/7/94	156	5.9	150	15.6	0.65	0.43	<0.01	0.19	0.03	7.6	24.2	19.6	28.8	12.4
T9U	6-12	3/17/94	12/7/94	4	6.2	-2.2	0.4	0.66	0.45	0.01	0.2	<0.01	5.0	4.3	10.0	32.4	24.8
T9U	0-6	3/17/94	12/7/94	63	18	45	6.3	0.84	0.21	<0.01	0.58	0.05	7.4	19.6	21.2	2.2	15.4
T10U	0-6	3/17/94	12/7/94	58	23	35	5.8	1.18	0.38	<0.01	0.73	0.07	7.2	18.2	21.9	31.0	16.7
T10U	6-12	3/17/94	12/7/94	22	8.8	13.2	2.2	0.88	0.6	<0.01	0.28	<0.01	7.9	12.8	30.4	32.5	13.2
T11M	6-12	3/17/94	12/7/94	15	16.9	-1.9	1.5	0.87	0.23	<0.01	0.54	0.1	7.7	61.5	18.4	10.7	3.9
T11M	0-6	3/17/94	12/7/94	29	42	-13	2.9	1.78	0.31	0.03	1.33	0.11	7.4	36.0	23.3	22.9	8.8
T12M	6-12	3/17/94	12/7/94	0.5	78	-77.5	<0.1	3.73	0.79	0.16	2.49	0.29	2.9	38.3	22.4	18.3	7.3
T12M	0-6	3/17/94	12/7/94	30	42.5	-12.5	3	2.12	0.52	0.1	1.36	0.14	6.9	26.6	24.5	26.4	10.9
T13M	6-12	3/17/94	12/7/94	17	20.9	-3.9	1.7	1.16	0.45	<0.01	0.67	0.04	7.5	20.3	30.0	34.1	8.7

Table H.3 (Continued) Static Test Results - Embankment Sample (NP, AP, ABA, units are tons CaCO<sub>3</sub>/ktons)

Sample ID	Depth	Sample Collection Date	Sample Analysis Date	NP	AP	ABA	Lime % as CaCO <sub>3</sub>	Total Sulfur %	Hot H <sub>2</sub> O Extractable Sulfur %	HCl Extractable Sulfur %	HNO <sub>3</sub> Extract Sulfur %	Residual Sulfur, %	Paste pH	Percent Retained by:			
														60	100	200	400
T13M	0-6	3/17/94	12/7/94	25	25.3	-0.3	2.5	1.04	0.13	<0.01	0.81	0.1	7.7	26.0	32.3	27.1	7.9
T14M	6-12	3/17/94	12/7/94	112	25	87	11.2	1.32	0.47	<0.01	0.8	0.05	7.5	25.9	23.5	24.4	10.3
T14M	0-6	3/17/94	12/7/94	59	40	19	5.9	1.72	0.39	<0.01	1.28	0.05	7.2	21.3	20.9	28.7	12.8
T15M	6-12	3/17/94	12/7/94	72	39	33	7.2	1.58	0.21	<0.01	1.25	0.12	7.6	28.1	24.6	24.9	10.1
T15M	0-6	3/17/94	12/7/94	73	46	27	7.3	1.57	<0.01	<0.01	1.48	0.09	7.6	26.3	25.5	25.3	10.2
T16M	6-12	3/17/94	12/7/94	73	27	46	7.3	1.26	0.32	<0.01	0.87	0.07	7.8	24.1	23.2	27.4	11.9
T16M	0-6	3/17/94	12/7/94	65	25	40	6.5	1.31	0.43	<0.01	0.81	0.07	7.9	24.8	22.3	25.6	12.9
T17M	6-12	3/17/94	12/7/94	6	17	-11	0.6	0.86	<0.01	0.27	0.55	0.04	4.3	33.8	28.4	21.1	8.2
T17M	0-6	3/17/94	12/7/94	39	52	-13	3.9	1.76	<0.01	<0.01	1.65	0.11	8.0	31.6	25.5	22.6	9.1
T18M	0-6	3/18/94	12/7/94	17	48	-31	1.7	1.99	<0.01	0.31	1.53	0.15	6.5	40.8	23.8	17.5	7.1
T19M	6-12	3/18/94	12/7/94	3	3.1	-0.1	0.3	0.48	0.36	0.02	0.1	<0.01	3.4	7.2	18.3	35.5	21.1
T20M	6-12	3/18/94	12/7/94	115	15	100	11.5	0.71	0.22	<0.01	0.49	<0.01	7.5	19.9	23.4	26.2	12.7
T20M	0-6	3/18/94	12/7/94	22	31	-9.0	2.2	1.18	<0.01	0.15	0.98	0.05	7.7	17.9	21.6	28.5	16.6
T21M	0-6	3/18/94	12/7/94	0.5	11	-10.5	<0.1	1.7	0.82	0.45	0.35	0.08	3.5	4.4	11.2	27.3	25.1
T21M	6-12	3/18/94	12/7/94	0.5	12	-11.5	<0.1	0.85	0.28	0.18	0.39	<0.01	3.1	21.1	22.5	26.3	11.8
T22M	6-12	3/18/94	12/7/94	0.5	12.5	-12	<0.1	1.13	0.56	0.13	0.4	0.04	2.6	31.8	17.5	17.7	11.0
T22M	0-6	3/18/94	12/7/94	0.5	15	-14.5	<0.1	1.18	0.67	<0.01	0.48	0.03	2.8	28.3	18.9	21.0	11.0
T20M2	0-6	3/18/94	12/7/94	0.5	7.8	-7.3	<0.1	1.21	0.67	0.29	0.25	<0.01	2.8	13.7	19.8	26.9	17.5
T20M2	6-12	3/18/94	12/7/94	0.5	12	-11.5	<0.1	1.18	0.81	<0.01	0.37	<0.01	3.4	17.4	21.5	26	12.7
T2U	6-12	3/16/94	12/7/94	18	45	-27	1.8	1.63	0.09	<0.01	1.44	0.1	7.5	23.7	18.2	26.3	15.2
T2U	0-6	3/16/94	12/7/94	23	41	-18	2.3	1.57	<0.01	0.15	1.31	0.11	7.6	28	20.3	22.6	13.6
T3U	0-6	3/16/94	12/7/94	18	64	-46	1.8	2.24	0.03	<0.01	2.05	0.16	7.5	30.5	27.5	22.3	9.3
TSU	6-12	3/17/94	12/7/94	14	29	-15	1.4	1.05	<0.01	0.03	0.93	0.09	8.2	15.5	36.3	29.9	9.3
T6U	6-12	3/17/94	12/7/94	32	46	-14	3.2	1.78	0.04	0.03	1.47	0.24	7.7	40.5	27.6	19.3	6.0
T6U	0-6	3/17/94	12/7/94	41	53	-12	4.1	2.21	0.29	<0.01	1.7	0.22	7.7	32.5	22.4	20.4	9.8
T7US	0-6	3/18/94	12/7/94	16	34	-18	1.6	1.22	<0.01	<0.01	1.08	0.14	7.2	31.7	29.3	24.0	7.0

Table H.3 (Continued) Static Test Results - Embankment Sample (NP, AP, ABA, units are tons CaCO<sub>3</sub>/ktons)

Sample ID	Depth	Sample Collection Date	Sample Analysis Date	NP	AP	ABA	Lime % as CaCO <sub>3</sub>	Total Sulfur %	Hot H <sub>2</sub> O Extractable Sulfur %	HCl Extractable Sulfur %	HNO <sub>3</sub> Extract Sulfur %	Residual Sulfur, %	Paste pH	Percent Retained by:			
														60	100	200	400
T8US	6-12	3/18/94	12/7/94	45	34	11	4.5	1.41	0.25	<0.01	1.1	0.06	7.6	23.1	25.3	25.9	12.0
T8US	0-6	3/18/94	12/7/94	57	33	24	5.7	1.3	0.15	<0.01	1.07	0.08	7.4	21.5	23.3	25.9	13.0
T9US	6-12	3/18/94	12/7/94	70	20	50	7	0.96	0.25	<0.01	0.65	0.06	7.6	22.8	21.2	25.9	13.3
T9US	0-6	3/18/94	12/7/94	68	22	46	6.8	0.97	0.22	<0.01	0.69	0.06	7.9	18.4	19.2	26.5	15.1
T10US	6-12	3/18/94	12/7/94	37	11.2	25.8	3.7	0.49	0.03	0.07	0.36	0.03	7.6	11.6	24.7	32.6	15.3
T11U	6-12	3/17/94	12/7/94	36	1.9	34	3.6	0.16	0.1	<0.01	0.06	<0.01	8.0	2.8	14.3	30.4	22.7
T11U	0-6	3/17/94	12/7/94	39	35.3	3.7	3.9	1.27	0.02	0.04	1.13	0.08	7.8	23.7	25.4	26.1	12.1
T14U	0-6	3/17/94	12/7/94	2	22	-20	0.2	1.1	0.37	<0.01	0.7	0.03	4.5	13.0	31.7	30.3	13.1
T15U	6-12	3/17/94	12/7/94	14	17.2	-3.2	1.4	0.7	0.14	0.01	0.55	<0.01	7.8	1.5	9.7	33.7	31.3
T16U	0-6	3/17/94	12/7/94	25	10	15	2.5	0.55	0.15	<0.01	0.33	0.07	7.9	8.9	25.8	33.1	15.3
T17U	0-6	3/17/94	12/7/94	22	15.3	6.7	2.2	0.79	0.18	<0.01	0.49	0.12	7.9	9.6	18.6	31.8	21.0
T18UB	6-12	3/18/94	12/7/94	48	25	23	4.8	1.09	0.23	<0.01	0.8	0.06	7.8	17.2	24	27.5	14
T18U	0-6	3/18/94	12/7/94	38	25	13	3.8	0.96	0.09	<0.01	0.81	0.06	7.8	14.0	24.4	30.0	14.3
T19U	6-12	3/18/94	12/7/94	27	12	15	2.7	0.56	0.16	<0.01	0.39	0.01	7.8	17.2	29.8	26.3	11.9
T20U	6-12	3/18/94	12/7/94	16	3.1	12.9	1.6	0.25	0.15	<0.01	0.1	<0.01	7.9	5.7	23.0	33.1	17.1
T20U	0-6	3/18/94	12/7/94	11	4.1	6.9	1.1	0.16	0.03	<0.01	0.13	<0.01	7.9	8.8	24.3	29.2	18.1
T21U	6-12	3/18/94	12/7/94	26	17.8	8.2	2.6	0.71	0.09	0.03	0.57	0.02	7.8	12.4	22.6	26.6	18.5
T21U	0-6	3/18/94	12/7/94	31	27.8	3.2	3.1	0.95	<0.01	0.02	0.89	0.04	7.7	15.8	22.6	24.5	15.6
T21UB	6-12	3/18/94	12/7/94	22	20.9	1.1	2.2	0.78	<0.01	0.06	0.67	0.05	8.1	11.3	22.4	27	19

Table H.4 Static Test Results - Interior Surface Samples (NP, AP, ABA, units are tons CaCO<sub>3</sub>/ktons)

Sample ID	Sample Collection Date	Sample Analysis Date	NP	AP	ABA	Lime, % as CaCO <sub>3</sub>	Total Sulfur %	Hot H <sub>2</sub> O Extractable Sulfur %	HCl Extractable Sulfur %	HNO <sub>3</sub> Extract Sulfur %	Residual Sulfur, %	Paste pH	Percent Retained by:			
													60	100	200	400
001-01	3/16/94	12/7/94	11	6.2	4.8	1.1	0.35	0.15	<0.01	0.2	<0.01	7.9	2.2	27.4	60.1	5.6
002-01	3/16/94	12/7/94	19	5.0	14	1.9	0.23	0.07	<0.01	0.16	<0.01	7.8	0.6	0.9	4.4	13.6
003-01	3/16/94	12/7/94	21	6.9	14.1	2.1	0.37	0.11	<0.01	0.22	0.04	8	1.2	25.8	58.1	9.9
101-01	3/16/94	12/7/94	21	10.6	9.4	2	0.39	0.03	<0.01	0.34	0.02	8.1	1.8	25.6	58.1	10.1

Table H.5 Static Test Results - Cyclone Sample (NP, AP, ABA, units are tons CaCO<sub>3</sub>/ktons)

Sample ID	Sample Collection Date	Sample Analysis Date	NP	AP	ABA	Lime % as CaCO <sub>3</sub>	Total Sulfur %	Hot H <sub>2</sub> O Extractable Sulfur %	HCl Extractable Sulfur %	HNO <sub>3</sub> Extract Sulfur %	Residual Sulfur %	Paste pH	Percent Retained by:			
													60	100	200	400
Feed 5/6	5/6/94	12/7/94	19	10.9	8.1	1.9	0.56	0.18	<0.01	0.35	0.03	7.9	2.1	9.2	17.4	20.8
Feed 4/29	4/29/94	12/7/94	15	4.4	10.6	1.5	0.24	0.08	<0.01	0.14	0.02	8.3	2.8	8.5	16.3	18.9
Feed 5/16	5/16/94	3/1/95	16	55	-39	1.6	2.43	0.38	<0.01	1.75	0.3	8.1	25.4	41.1	23.2	4.8
Overflow 5/06	5/6/94	12/7/94	40	22	18	4	0.99	0.21	<0.01	0.72	0.06	7.9	0.1	0.2	5.2	22
Overflow 5/16	5/16/94	12/7/94	24	11	13	2.4	0.47	0.13	<0.01	0.34	<0.01	8.1	0.2	1	15.3	37
Overflow 4/29	4/29/94	12/7/94	13	2.5	10.5	1.3	0.14	0.06	<0.01	0.08	<0.01	8.2	0.2	0.4	11.1	27
Overflow 4/22	4/22/94	12/7/94	21	5.0	16	2.1	0.24	0.08	<0.01	0.16	<0.01	8	0.3	0.9	11.8	22.9
Overflow 1/26	1/26/94	12/7/94	22	6.6	15.4	2.2	0.27	0.06	<0.01	0.21	<0.01	8.2	0.2	8.8	24.7	22.7
Underflow 5/16	5/16/94	12/7/94	23	86	-63	2.3	3.84	0.2	0.51	2.75	0.38	8	13.4	40.8	33.4	7.8
Underflow 5/06	5/6/94	12/7/94	16	16.9	-0.9	1.6	0.83	0.07	0.12	0.54	0.1	8.1	9.9	34.4	41.5	8.5
Underflow 4/07	4/7/94	12/7/94	18	4.7	13.3	1.8	0.23	0.08	<0.01	0.15	<0.01	8.2	5	37	40.2	8.5
Underflow 4/22	4/22/94	12/7/94	16	5	11	1.6	0.28	0.04	0.02	0.16	0.06	8.3	7.3	33.2	46.7	8
Underflow 1/25	1/25/94	12/7/94	28	8.1	19.9	2.8	0.56	0.16	<0.01	0.26	0.14	8.1	13.5	39.7	22.1	8.5
Underflow 1/27	1/27/94	12/7/94	17	5.9	11.1	1.7	0.46	0.13	<0.01	0.19	0.14	8.1	4.7	38.5	39.9	7.9
Underflow 4/12	4/12/94	3/1/95	13	7.5	5.5	1.3	0.38	0.09	<0.01	0.24	0.05	8.2	7	33.3	52.7	5.3

Table H.6 Static Test Results - Test Fill Data (NP, AP, ABA, units are tons CaCO<sub>3</sub>/ktons)

Sample ID	Sample Collection Date	Sample Analysis Date	NP	AP	ABA	Lime % as CaCO <sub>3</sub>	Total Sulfur %	Hot H <sub>2</sub> O Extractable Sulfur %	HCl Extractable Sulfur %	HNO <sub>3</sub> Extract Sulfur %	Residual Sulfur %
PLOT 2-6'	7/20/94	10/3/94	7.0	6.6	0.44	0.7	0.32	0.07	<0.01	0.21	0.04
PLOT 2-8'	7/20/94	10/3/94	8.0	7.5	0.5	0.8	0.36	0.05	0.03	0.24	0.04
PLOT 3-3'	7/20/94	10/3/94	15	15.3	-0.3	1.5	0.64	0.02	0.07	0.49	0.06
PLOT 3-6'	7/20/94	10/3/94	7.0	7.8	-0.8	0.7	0.33	0.03	0.01	0.25	0.04
PLOT 3-8'	7/20/94	10/3/94	29	11	18	2.9	0.50	0.08	<0.01	0.36	0.06
PLOT 4-3'	7/20/94	10/3/94	10	17.8	-7.8	1.0	0.75	0.10	0.01	0.57	0.07
PLOT 4-6'	7/20/94	10/3/94	13	16.2	-3.2	1.3	0.67	0.09	<0.01	0.52	0.06



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## LABORATORY REPORT

TO: Mike Shields  
ADDRESS: Shepherd Miller, Inc.  
1600 Specht Point Drive  
Suite F  
Fort Collins, CO 80525

LAB NO.: 94-57638 -41  
DATE: 12/07/94 da

SOIL ANALYSIS

Proj. No. 02370-2  
Submitted 11/16/94

Sample No.	57638	57639	57640
Location	T5M 0-6-01	T2U 0-6-01	T2L 6-12-01
Lime, % as CaCO <sub>3</sub>	6.0	2.3	1.2
Neut. Pot., T/1000 Tons (1)	60	23	12
Acid Pot., T/1000 Tons (1)	69	49	11
Acid/Base Pot., T/1000 Tons (1)	-9	-26	1
Total Sulfur %	2.36	1.57	0.80
Hot H <sub>2</sub> O Extractable Sulfur %	0.14	<0.01	0.45
HCl Extractable Sulfur %	<0.01	0.15	<0.01
HNO <sub>3</sub> Extractable Sulfur %	2.10	1.31	0.32
Residual Sulfur, %	0.12	0.11	0.03
(1) T CaCO <sub>3</sub> /1000 Tons Soil			

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TO: Mike Shields  
ADDRESS: Shepherd Miller, Inc.  
1600 Specht Point Drive  
Suite F  
Fort Collins, CO 80525

LAB NO.: 94-57638 -41  
DATE: 12/07/94 da

**SOIL ANALYSIS**

Proj. No. 02370-2  
Submitted 11/16/94

Sample No.	57641
Location	T2L 0-6-01
Lime, % as CaCO <sub>3</sub>	1.0
Neut. Pot., T/1000 Tons (1)	10
Acid Pot., T/1000 Tons (1)	13
Acid/Base Pot., T/1000 Tons (1)	-3
Total Sulfur %	0.62
Hot H <sub>2</sub> O Extractable Sulfur %	0.21
HCl Extractable Sulfur %	<0.01
HNO <sub>3</sub> Extractable Sulfur %	0.37
Residual Sulfur, %	0.04
(1) T CaCO <sub>3</sub> /1000 Tons Soil	

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TO: Mike Shields  
ADDRESS: Shepherd Miller, Inc.  
1600 Specht Point Drive  
Suite F  
Fort Collins, CO 80525

LAB NO.: 94-57640 dup  
DATE: 12/07/94 da

**QUALITY ASSURANCE-DUPLICATE ANALYSIS**

Proj. No. 02370-2  
Submitted 11/16/94

Sample No.	57640DUP
Location	T2L 6-12-01
Lime, % as CaCO <sub>3</sub>	1.2
Neut. Pot., T/1000 Tons (1)	12
Acid Pot., T/1000 Tons (1)	13
Acid/Base Pot., T/1000 Tons (1)	-0
Total Sulfur %	0.80
Hot H <sub>2</sub> O Extractable Sulfur %	0.40
HCl Extractable Sulfur %	<0.01
HNO <sub>3</sub> Extractable Sulfur %	0.37
Residual Sulfur, %	0.03
(1) T CaCO <sub>3</sub> /1000 Tons Soil	

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**LABORATORY REPORT**

**TO:** Mike Shields  
**ADDRESS:** Shepherd Miller, Inc.  
1600 Specht Point Drive  
Suite F  
Fort Collins, CO 80525

**LAB NO.:** 94-57638 -41  
**DATE:** 12/07/94 da

**QUALITY ASSURANCE-CONTROL SOIL ANALYSIS**

This Quality Assurance-Control Soil Analysis was run with  
your Lab Nos. 94-57638 through 94-57641 with the following results:

Sample No. Location	CONTROL SOIL ANALYSIS	TARGET RANGE
Lime, % as CaCO <sub>3</sub>	4.9	3.6 - 7.5
Neut. Pot., T/1000 Tons (1)	49	33 - 77
Acid Pot., T/1000 Tons (1)	5	0 - 9
Acid/Base Pot., T/1000 Tons (1)	44	33 - 74
Total Sulfur %	0.18	0.02 - 0.25
Hot H <sub>2</sub> O Extractable Sulfur %	0.01	0.01 - 0.04
HCl Extractable Sulfur %	<0.01	<0.01
HNO <sub>3</sub> Extractable Sulfur %	0.17	0.01 - 0.20
Residual Sulfur, %	<0.01	<0.01
(1) T CaCO <sub>3</sub> /1000 Tons Soil		

Lab Nos. 94-57638-41

Date 11/16/94

Received by Randa Hoelscher

### SAMPLE CONDITION QA/QC REPORT

This report provides information about the condition of the sample(s) and associated sample custody information on receipt at the laboratory.

Chain-of-custody form completed & signed	<u>Yes</u>	Comments: _____
Chain-of-custody seal properly placed	<u>N/A</u>	Comments: No Seal _____
Chain-of-custody seal intact	<u>N/A</u>	Comments: _____
Signature Match, Chain-of-custody vs. Seal	<u>N/A</u>	Comments: _____
Sample received cold	<u>N/A</u>	Comments: _____
Samples received within holding time	<u>N/A</u>	Comments: _____
Samples received in proper containers and properly preserved	<u>N/A</u>	Comments: _____
Client notified about sample discrepancies	_____	Comments: _____
Who: _____	By: _____	Date/Time: _____

Method of Shipment Federal Express 3525191412



## ENERGY LABORATORIES, INC.

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## LABORATORY REPORT

TO: Michael Shields  
ADDRESS: Shepherd Miller, Inc.  
1600 Specht Point Drive  
Suite F  
Fort Collins, CO 80525

LAB NO.: 95-18940-2  
DATE: 03/01/95 jmw

SOIL ANALYSIS

Submitted 02/15/95

Sample No.	18940	18941	18942
Location	Underflow 3/16 KVC	Underflow 4/12	Feed 5/16
Lime, % as CaCO <sub>3</sub>	2.4	1.3	1.6
Neut. Pot., T/1000 Tons (1)	24	13	16
Acid Pot., T/1000 Tons (1)	15	9	64
Acid/Base Pot., T/1000 Tons (1)	9	4	-48
Total Sulfur %	0.58	0.38	2.43
Hot H <sub>2</sub> O Extractable Sulfur %	0.10	0.09	0.38
HCl Extractable Sulfur %	<0.01	<0.01	<0.01
HNO <sub>3</sub> Extractable Sulfur %	0.44	0.24	1.75
Residual Sulfur, %	0.04	0.05	0.30

(1) T CaCO<sub>3</sub>/1000 Tons Soil



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## LABORATORY REPORT

TO: Michael Shields  
ADDRESS: Shepherd Miller, Inc.  
1600 Specht Point Drive  
Suite F  
Fort Collins, CO 80525

LAB NO.: 95-18940 dup  
DATE: 03/01/95 jmw

QUALITY ASSURANCE - DUPLICATE ANALYSIS

Submitted 02/15/95

Sample No. 18940DUP  
Location Underflow  
3/16

Lime, % as CaCO <sub>3</sub>	2.5
Neut. Pot., T/1000 Tons (1)	25
Acid Pot., T/1000 Tons (1)	15
Acid/Base Pot., T/1000 Tons (1)	10
Total Sulfur %	0.57
Hot H <sub>2</sub> O Extractable Sulfur %	0.10
HCl Extractable Sulfur %	<0.01
HNO <sub>3</sub> Extractable Sulfur %	0.44
Residual Sulfur, %	0.03
(1) T CaCO <sub>3</sub> /1000 Tons Soil	

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**TO:** Michael Shields  
**ADDRESS:** Shepherd Miller, Inc.  
1600 Specht Point Drive  
Suite F  
Fort Collins, CO 80525

**LAB NO.:** 95-18940-2  
**DATE:** 03/01/95 jmw

**QUALITY ASSURANCE - CONTROL SOIL ANALYSIS**

This Quality Assurance - Control Soil Analysis was run  
with Lab Nos. 95-18940 through 95-18942 with the following results:

Sample No. Location	CONTROL SOIL ANALYSIS	TARGET RANGE
Lime, % as CaCO <sub>3</sub>	6.7	3.6 - 7.5
Neut. Pot., T/1000 Tons (1)	67	33 - 77
Acid Pot., T/1000 Tons (1)	4	0 - 9
Acid/Base Pot., T/1000 Tons (1)	62	33 - 74
Total Sulfur %	0.17	0.02 - 0.25
Hot H <sub>2</sub> O Extractable Sulfur %	0.03	0.01 - 0.04
HCl Extractable Sulfur %	<0.01	<0.01
HNO <sub>3</sub> Extractable Sulfur %	0.14	0.01 - 0.20
Residual Sulfur, %	<0.01	<0.01
(1) T CaCO <sub>3</sub> /1000 Tons Soil		



## ENERGY LABORATORIES, INC.

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Lab Nos. 95-18940-2

Date 02/15/95

Received by Randa Hoelscher

### SAMPLE CONDITION QA/QC REPORT

This report provides information about the condition of the sample(s) and associated sample custody information on receipt at the laboratory.

Chain-of-custody form completed & signed	<u>N/A</u>	Comments: <u>No chain of custody</u>
Chain-of-custody seal properly placed	<u>N/A</u>	Comments: <u>No seal</u>
Chain-of-custody seal intact	<u>N/A</u>	Comments: _____
Signature Match, Chain-of-custody vs. Seal	<u>N/A</u>	Comments: _____
Sample received cold	<u>No</u>	Comments: _____
Samples received within holding time	<u>N/A</u>	Comments: <u>No sample date</u>
Samples received in proper containers and properly preserved	<u>Yes</u>	Comments: _____
Client notified about sample discrepancies	_____	Comments: _____
Who:	By:	Date/Time: _____

Method of Shipment Federal Express #4293678001



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## LABORATORY REPORT

TO: Michael Shields  
ADDRESS: Shepherd Miller, Inc.  
1600 Specht Point Drive, Suite F  
Fort Collins, CO 80525

LAB NO.: 94-44318-45  
DATE: 10/03/94 jmw

SOIL ANALYSIS

374 Test Fill  
Submitted 09/12/94

Sample No. Location	44333 Plot 3-6'-01	44334 Plot 3-8'-01	44335 Plot 3-9'-01
Lime, % as CaCO <sub>3</sub>	0.7	2.9	6.7
Neut. Pot., T/1000 Tons (1)	7	29	67
Acid Pot., T/1000 Tons (1)	9	13	20
Acid/Base Pot., T/1000 Tons (1)	-2	16	48
Total Sulfur %	0.33	0.50	0.63
Hot H <sub>2</sub> O Extractable Sulfur %	0.03	0.08	<0.01
HCl Extractable Sulfur %	0.01	<0.01	<0.01
HNO <sub>3</sub> Extractable Sulfur %	0.25	0.36	0.26
Residual Sulfur, %	0.04	0.06	0.37

(1) T CaCO<sub>3</sub>/1000 Tons Soil



## ENERGY LABORATORIES, INC.

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## LABORATORY REPORT

TO: Michael Shields  
ADDRESS: Shepherd Miller, Inc.  
1600 Specht Point Drive, Suite F  
Fort Collins, CO 80525

LAB NO.: 94-44318-45  
DATE: 10/03/94 jmw

SOIL ANALYSIS

374 Test Fill  
Submitted 09/12/94

Sample No. Location	44330 Plot 2-8'-01	44331 Plot 2-12.5'	44332 Plot 3-3'-01
Lime, % as CaCO <sub>3</sub>	0.8	4.0	1.5
Neut. Pot., T/1000 Tons (1)	8	40	15
Acid Pot., T/1000 Tons (1)	10	16	19
Acid/Base Pot., T/1000 Tons (1)	-1	25	-4
Total Sulfur %	0.36	0.56	0.64
Hot H <sub>2</sub> O Extractable Sulfur %	0.05	0.06	0.02
HCl Extractable Sulfur %	0.03	0.01	0.07
HNO <sub>3</sub> Extractable Sulfur %	0.24	0.30	0.49
Residual Sulfur, %	0.04	0.19	0.06

(1) T CaCO<sub>3</sub>/1000 Tons Soil



## ENERGY LABORATORIES, INC.

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## LABORATORY REPORT

TO: Michael Shields  
ADDRESS: Shepherd Miller, Inc.  
1600 Specht Point Drive, Suite F  
Fort Collins, CO 80525

LAB NO.: 94-44318-45  
DATE: 10/03/94 jmw

SOIL ANALYSIS

374 Test Fill  
Submitted 09/12/94

Sample No. Location	44327 K121-01	44328 K122-01	44329 Plot 2-6'-01
Lime, % as CaCO <sub>3</sub>	2.5	2.1	0.7
Neut. Pot., T/1000 Tons (1)	25	21	7
Acid Pot., T/1000 Tons (1)	26	13	8
Acid/Base Pot., T/1000 Tons (1)	-0	9	-0
Total Sulfur %	0.99	0.49	0.32
Hot H <sub>2</sub> O Extractable Sulfur %	0.17	0.08	0.07
HCl Extractable Sulfur %	<0.01	<0.01	<0.01
HNO <sub>3</sub> Extractable Sulfur %	0.77	0.36	0.21
Residual Sulfur, %	0.05	0.05	0.04

(1) T CaCO<sub>3</sub>/1000 Tons Soil



## ENERGY LABORATORIES, INC.

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## LABORATORY REPORT

TO: Michael Shields  
ADDRESS: Shepherd Miller, Inc.  
1600 Specht Point Drive, Suite F  
Fort Collins, CO 80525

LAB NO.: 94-44318-45  
DATE: 10/03/94 jmw

SOIL ANALYSIS

374 Test Fill  
Submitted 09/12/94

Sample No. Location	44324 K118-01	44325 K119-01	44326 K120-01
Lime, % as CaCO <sub>3</sub>	1.8	1.5	1.6
Neut. Pot., T/1000 Tons (1)	18	15	16
Acid Pot., T/1000 Tons (1)	11	46	31
Acid/Base Pot., T/1000 Tons (1)	7	-31	-15
Total Sulfur %	0.42	1.60	1.08
Hot H <sub>2</sub> O Extractable Sulfur %	0.06	0.14	0.08
HCl Extractable Sulfur %	0.02	0.03	0.04
HNO <sub>3</sub> Extractable Sulfur %	0.28	1.35	0.91
Residual Sulfur, %	0.06	1.43	0.96

(1) T CaCO<sub>3</sub>/1000 Tons Soil



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## LABORATORY REPORT

TO: Michael Shields  
ADDRESS: Shepherd Miller, Inc.  
1600 Specht Point Drive, Suite F  
Fort Collins, CO 80525

LAB NO.: 94-44318-45  
DATE: 10/03/94 jmw

SOIL ANALYSIS

374 Test Fill  
Submitted 09/12/94

Sample No.	44321 K115-01	44322 K116-01	44323 K117-01
Lime, % as CaCO <sub>3</sub>	1.7	2.1	2.0
Neut. Pot., T/1000 Tons (1)	17	21	20
Acid Pot., T/1000 Tons (1)	27	27	22
Acid/Base Pot., T/1000 Tons (1)	-10	-6	-1
Total Sulfur %	0.95	0.87	0.81
Hot H <sub>2</sub> O Extractable Sulfur %	0.10	<0.01	0.11
HCl Extractable Sulfur %	0.16	0.11	<0.01
HNO <sub>3</sub> Extractable Sulfur %	0.62	0.69	0.65
Residual Sulfur, %	0.07	0.07	0.05
(1) T CaCO <sub>3</sub> /1000 Tons Soil			



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## LABORATORY REPORT

TO: Michael Shields  
ADDRESS: Shepherd Miller, Inc.  
1600 Specht Point Drive, Suite F  
Fort Collins, CO 80525

LAB NO.: 94-44318-45  
DATE: 10/03/94 jmw

SOIL ANALYSIS

374 Test Fill  
Submitted 09/12/94

Sample No. Location	44318 K112-01	44319 K113-01	44320 K114-01
Lime, % as CaCO <sub>3</sub>	3.2	6.0	2.0
Neut. Pot., T/1000 Tons (1)	32	60	20
Acid Pot., T/1000 Tons (1)	50	40	26
Acid/Base Pot., T/1000 Tons (1)	-18	20	-6
Total Sulfur %	1.91	1.31	0.94
Hot H <sub>2</sub> O Extractable Sulfur %	0.30	0.03	0.11
HCl Extractable Sulfur %	<0.01	<0.01	0.08
HNO <sub>3</sub> Extractable Sulfur %	1.47	1.20	0.70
Residual Sulfur, %	0.14	0.08	0.05

(1) T CaCO<sub>3</sub>/1000 Tons Soil

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FAX (406) 252-6069 • 1-800-735-4489**LABORATORY REPORT**

TO: Michael Shields  
ADDRESS: Shepherd Miller, Inc.  
1600 Specht Point Drive, Suite F  
Fort Collins, CO 80525

LAB NO.: 94-44318-45  
DATE: 10/03/94 jmw

**SOIL ANALYSIS**

374 Test Fill  
Submitted 09/12/94

Sample No.	44345
Location	K113-04
Lime, % as CaCO <sub>3</sub>	2.0
Neut. Pot., T/1000 Tons (1)	20
Acid Pot., T/1000 Tons (1)	13
Acid/Base Pot., T/1000 Tons (1)	6
Total Sulfur %	0.62
Hot H <sub>2</sub> O Extractable Sulfur %	0.19
HCl Extractable Sulfur %	<0.01
HNO <sub>3</sub> Extractable Sulfur %	0.37
Residual Sulfur, %	0.06
(1) T CaCO <sub>3</sub> /1000 Tons Soil	



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SOIL ANALYSIS

374 Test Fill  
Submitted 09/12/94

Sample No. Location	44342 Plot 3-3'-04	44343 K113-02	44344 K113-03
Lime, % as CaCO <sub>3</sub>	2.0	5.1	3.2
Neut. Pot., T/1000 Tons (1)	20	51	32
Acid Pot., T/1000 Tons (1)	13	31	12
Acid/Base Pot., T/1000 Tons (1)	7	20	20
Total Sulfur %	0.56	1.24	0.46
Hot H <sub>2</sub> O Extractable Sulfur %	0.16	0.25	0.09
HCl Extractable Sulfur %	<0.01	<0.01	<0.01
HNO <sub>3</sub> Extractable Sulfur %	0.34	0.90	0.35
Residual Sulfur, %	0.06	0.09	0.02

(1) T CaCO<sub>3</sub>/1000 Tons Soil



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SOIL ANALYSIS

374 Test Fill  
Submitted 09/12/94

Sample No. Location	44339 Plot 4-'8.5'	44340 Plot 3-3'-02	44341 Plot 3-3'-03
Lime, % as CaCO <sub>3</sub>	3.1	1.7	3.0
Neut. Pot., T/1000 Tons (1)	31	17	30
Acid Pot., T/1000 Tons (1)	14	18	12
Acid/Base Pot., T/1000 Tons (1)	17	-1	18
Total Sulfur %	0.53	0.66	0.46
Hot H <sub>2</sub> O Extractable Sulfur %	0.08	0.08	0.07
HCl Extractable Sulfur %	<0.01	<0.01	<0.01
HNO <sub>3</sub> Extractable Sulfur %	0.34	0.51	0.37
Residual Sulfur, %	0.11	0.07	0.02

(1) T CaCO<sub>3</sub>/1000 Tons Soil



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SOIL ANALYSIS

374 Test Fill  
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Sample No. Location	44336 Plot 3-10.5'	44337 Plot 4-3'-01	44338 Plot 4-'6'
Lime, % as CaCO <sub>3</sub>	6.3	1.0	1.3
Neut. Pot., T/1000 Tons (1)	63	10	13
Acid Pot., T/1000 Tons (1)	21	20	18
Acid/Base Pot., T/1000 Tons (1)	42	-10	-5
Total Sulfur %	0.69	0.75	0.67
Hot H <sub>2</sub> O Extractable Sulfur %	0.01	0.10	0.09
HCl Extractable Sulfur %	<0.01	0.01	<0.01
HNO <sub>3</sub> Extractable Sulfur %	0.22	0.57	0.52
Residual Sulfur, %	0.46	0.07	0.06
(1) T CaCO <sub>3</sub> /1000 Tons Soil			



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## LABORATORY REPORT

TO: Michael Shields  
ADDRESS: Shepherd Miller, Inc.  
1600 Specht Point Drive, Suite F  
Fort Collins, CO 80525

LAB NO.: 94-44320, 44330, 44340 dup  
DATE: 10/03/94 jmw

QUALITY ASSURANCE - DUPLICATE ANALYSIS

374 Test Fill  
Submitted 09/12/94

Sample No. Location	44320DUP K114-01	44330DUP Plot 2-8'-01	44340DUP Plot 3-3'-02
Lime, % as CaCO <sub>3</sub>	2.0	0.9	1.5
Neut. Pot., T/1000 Tons (1)	20	9	15
Acid Pot., T/1000 Tons (1)	24	10	19
Acid/Base Pot., T/1000 Tons (1)	-4	-1	-3
Total Sulfur %	0.93	0.35	0.66
Hot H <sub>2</sub> O Extractable Sulfur %	0.16	0.04	0.06
HCl Extractable Sulfur %	0.05	0.04	<0.01
HNO <sub>3</sub> Extractable Sulfur %	0.68	0.22	0.53
Residual Sulfur, %	0.04	0.05	0.07
(1) T CaCO <sub>3</sub> /1000 Tons Soil			



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## LABORATORY REPORT

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1600 Specht Point Drive, Suite F  
Fort Collins, CO 80525

LAB NO.: 94-44318-45  
DATE: 10/03/94 jmw

QUALITY ASSURANCE - CONTROL SOIL ANALYSIS

This Quality Assurance - Control Soil Analysis was run with  
Lab Numbers 94-44318 through 94-44345 with the following results:

Sample No. Location	CONTROL SOIL ANALYSIS	TARGET RANGE
Lime, % as CaCO <sub>3</sub>	6.8	3.6 - 7.5
Neut. Pot., T/1000 Tons (1)	68	33 - 77
Acid Pot., T/1000 Tons (1)	5	0 - 9
Acid/Base Pot., T/1000 Tons (1)	62	33 - 74
Total Sulfur %	0.21	0.02 - 0.25
Hot H <sub>2</sub> O Extractable Sulfur %	0.04	0.01 - 0.04
HCl Extractable Sulfur %	<0.01	<0.01
HNO <sub>3</sub> Extractable Sulfur %	0.17	0.01 - 0.20
Residual Sulfur, %	<0.01	<0.01
(1) T CaCO <sub>3</sub> /1000 Tons Soil		

Lab Nos. 94-44318-45

Date 09/12/94

Received by Randa Hoelscher

### SAMPLE CONDITION QA/QC REPORT

This report provides information about the condition of the sample(s) and associated sample custody information on receipt at the laboratory.

Chain-of-custody form completed & signed	<u>Yes</u>	Comments: _____
Chain-of-custody seal properly placed	<u>N/A</u>	Comments: No seal
Chain-of-custody seal intact	_____	Comments: _____
Signature Match, Chain-of-custody vs. Seal	_____	Comments: _____
Sample received cold	<u>N/A</u>	Comments: _____
Samples received within holding time	<u>N/A</u>	Comments: _____
Samples received in proper containers and properly preserved	<u>N/A</u>	Comments: _____
Client notified about sample discrepancies	_____	Comments: _____
Who: _____	By: _____	Date/Time: _____

Method of Shipment Federal Express #2760919405



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## LABORATORY REPORT

TO: Mike Shields  
ADDRESS: Shepherd Miller, Inc.  
1600 Specht Point Drive  
Suite F  
Fort Collins, CO 80525

LAB NO.: 94-57274-57554  
DATE: 12/07/94 da

SOIL ANALYSIS

Proj. No. 370-02  
Submitted 11/15/94

Sample No.	57274	57275	57276
Location	S16-0-6 -01	S16 0-6-01	S2 6-12-01
Lime, % as CaCO <sub>3</sub>	4.3	4.9	2.2
Neut. Pot., T/1000 Tons (1)	43	49	22
Acid Pot., T/1000 Tons (1)	27	23	17
Acid/Base Pot., T/1000 Tons (1)	16	26	5
Total Sulfur %	0.95	0.73	0.55
Hot H <sub>2</sub> O Extractable Sulfur %	0.10	<0.01	<0.01
HCl Extractable Sulfur %	0.03	0.04	0.18
HNO <sub>3</sub> Extractable Sulfur %	0.74	0.62	0.33 = (0.55 - 0.18) - 0.04
Residual Sulfur, %	0.08	0.07	0.04

(1) T CaCO<sub>3</sub>/1000 Tons Soil



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## LABORATORY REPORT

TO: Mike Shields  
ADDRESS: Shepherd Miller, Inc.  
1600 Specht Point Drive  
Suite F  
Fort Collins, CO 80525LAB NO.: 94-57274-57554  
DATE: 12/07/94 daSOIL ANALYSISProj. No. 370-02  
Submitted 11/15/94

Sample No.	57277	57278	57279
Location	S9	S9	S9
	0-6-01	0-6-02	0-6-03
Lime, % as CaCO <sub>3</sub>	2.6	2.7	3.4
Neut. Pot., T/1000 Tons (1)	26	27	34
Acid Pot., T/1000 Tons (1)	18	19	12
Acid/Base Pot., T/1000 Tons (1)	8	8	21
Total Sulfur %	0.68	0.69	0.49
Hot H <sub>2</sub> O Extractable Sulfur %	0.11	0.08	0.10
HCl Extractable Sulfur %	<0.01	<0.01	<0.01
HNO <sub>3</sub> Extractable Sulfur %	0.56	0.61	0.39
Residual Sulfur, %	0.01	<0.01	<0.01
(1) T CaCO <sub>3</sub> /1000 Tons Soil			



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Fort Collins, CO 80525

LAB NO.: 94-57274-57554  
DATE: 12/07/94 da

SOIL ANALYSIS

Proj. No. 370-02  
Submitted 11/15/94

Sample No.	57280	57281	57282
Location	S9 0-6-04	S4 0-6-01	S5 6-12-01
Lime, % as CaCO <sub>3</sub>	2.3	1.8	2.5
Neut. Pot., T/1000 Tons (1)	23	18	25
Acid Pot., T/1000 Tons (1)	13	9	21
Acid/Base Pot., T/1000 Tons (1)	9	9	4
Total Sulfur %	0.57	0.35	0.67
Hot H <sub>2</sub> O Extractable Sulfur %	0.14	0.05	<0.01
HCl Extractable Sulfur %	0.15	<0.01	0.09
HNO <sub>3</sub> Extractable Sulfur %	0.21	0.23	0.49
Residual Sulfur, %	0.07	0.07	0.09
(1) T CaCO <sub>3</sub> /1000 Tons Soil			



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DATE: 12/07/94 da

SOIL ANALYSIS

Proj. No. 370-02  
Submitted 11/15/94

Sample No.	57283	57284	57285
Location	S17 6-12-01	S19 0-6-01	S14 0-6-01
Lime, % as CaCO <sub>3</sub>	2.0	1.4	2.8
Neut. Pot., T/1000 Tons (1)	20	14	28
Acid Pot., T/1000 Tons (1)	6	18	31
Acid/Base Pot., T/1000 Tons (1)	14	-4	-3
Total Sulfur %	0.29	0.68	1.30
Hot H <sub>2</sub> O Extractable Sulfur %	0.10	0.10	0.30
HCl Extractable Sulfur %	<0.01	<0.01	0.14
HNO <sub>3</sub> Extractable Sulfur %	0.19	0.50	0.80
Residual Sulfur, %	<0.01	0.08	0.06
(1) T CaCO <sub>3</sub> /1000 Tons Soil			



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LAB NO.: 94-57274-57554  
DATE: 12/07/94 da

SOIL ANALYSIS

Proj. No. 370-02  
Submitted 11/15/94

Sample No.	57286	57287	57288
Location	S11 0-6-01	S12 6-12-01	T2U 6-12-01
Lime, % as CaCO <sub>3</sub>	2.2	3.6	1.8
Neut. Pot., T/1000 Tons (1)	22	36	18
Acid Pot., T/1000 Tons (1)	14	18	48
Acid/Base Pot., T/1000 Tons (1)	8	17	-31
Total Sulfur %	0.54	0.58	1.63
Hot H <sub>2</sub> O Extractable Sulfur %	0.10	<0.01	0.09
HCl Extractable Sulfur %	0.04	0.16	<0.01
HNO <sub>3</sub> Extractable Sulfur %	0.37	0.34	1.44
Residual Sulfur, %	0.03	0.08	0.10

(1) T CaCO<sub>3</sub>/1000 Tons Soil



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DATE: 12/07/94 da

#### SOIL ANALYSIS

Proj. No. 370-02  
Submitted 11/15/94

Sample No.	57289	57290	57291
Location	T2U	S9	S7
	6-12-02	6-12-01	6-12-01
Lime, % as CaCO <sub>3</sub>	1.7	1.8	0.7
Neut. Pot., T/1000 Tons (1)	17	18	7
Acid Pot., T/1000 Tons (1)	45	8	6
Acid/Base Pot., T/1000 Tons (1)	-28	11	1
Total Sulfur %	1.66	0.38	0.23
Hot H <sub>2</sub> O Extractable Sulfur %	0.22	0.14	0.04
HCl Extractable Sulfur %	0.01	<0.01	0.01
HNO <sub>3</sub> Extractable Sulfur %	1.33	0.24	0.13
Residual Sulfur, %	0.10	<0.01	0.05

(1) T CaCO<sub>3</sub>/1000 Tons Soil



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DATE: 12/07/94 da

SOIL ANALYSIS

Proj. No. 370-02  
Submitted 11/15/94

Sample No.	57292	57293	57294
Location	S15 6-12-01	S18 6-12-01	S10 6-12-01
Lime, % as CaCO <sub>3</sub>	2.1	1.2	3.4
Neut. Pot., T/1000 Tons (1)	21	12	34
Acid Pot., T/1000 Tons (1)	20	8	42
Acid/Base Pot., T/1000 Tons (1)	1	3	-8
Total Sulfur %	0.63	0.33	1.43
Hot H <sub>2</sub> O Extractable Sulfur %	<0.01	0.06	0.08
HCl Extractable Sulfur %	0.03	<0.01	<0.01
HNO <sub>3</sub> Extractable Sulfur %	0.51	0.24	1.27
Residual Sulfur, %	0.09	0.03	0.08

(1) T CaCO<sub>3</sub>/1000 Tons Soil

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**SOIL ANALYSIS**

Proj. No. 370-02  
Submitted 11/15/94

Sample No.	57295	57296	57297
Location	T1L2 0-6-01	S20 6-12-01	S6 6-12-01
Lime, % as CaCO <sub>3</sub>	1.6	2.0	1.5
Neut. Pot., T/1000 Tons (1)	16	20	15
Acid Pot., T/1000 Tons (1)	20	16	4
Acid/Base Pot., T/1000 Tons (1)	-4	4	10
Total Sulfur %	0.73	0.55	0.27
Hot H <sub>2</sub> O Extractable Sulfur %	0.08	0.05	0.13
HCl Extractable Sulfur %	0.07	<0.01	<0.01
HNO <sub>3</sub> Extractable Sulfur %	0.51	0.42	0.14
Residual Sulfur, %	0.07	0.08	<0.01
(1) T CaCO <sub>3</sub> /1000 Tons Soil			

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**LAB NO.:** 94-57274-57554  
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**SOIL ANALYSIS**

Proj. No. 370-02  
Submitted 11/15/94

Sample No.	57298	57299	57300
Location	S16 6-12-01	S15 0-6-01	T2M 6-12-01
Lime, % as CaCO <sub>3</sub>	2.4	1.3	<0.1
Neut. Pot., T/1000 Tons (1)	24	13	<1
Acid Pot., T/1000 Tons (1)	13	5	15
Acid/Base Pot., T/1000 Tons (1)	11	8	-15
Total Sulfur %	0.55	0.19	1.22
Hot H <sub>2</sub> O Extractable Sulfur %	0.13	0.03	0.73
HCl Extractable Sulfur %	<0.01	<0.01	0.15
HNO <sub>3</sub> Extractable Sulfur %	0.39	0.16	0.32
Residual Sulfur, %	0.03	<0.01	0.02

(1) T CaCO<sub>3</sub>/1000 Tons Soil



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SOIL ANALYSIS

Proj. No. 370-02  
Submitted 11/15/94

Sample No.	57301	57302	57303
Location	T2M	T2M	T2M
	6-12-02	6-12-03	6-12-04
Lime, % as CaCO <sub>3</sub>	1.5	3.3	2.1
Neut. Pot., T/1000 Tons (1)	15	33	21
Acid Pot., T/1000 Tons (1)	15	11	16
Acid/Base Pot., T/1000 Tons (1)	-0	22	5
Total Sulfur %	1.23	0.46	0.76
Hot H <sub>2</sub> O Extractable Sulfur %	0.75	0.10	0.25
HCl Extractable Sulfur %	0.17	<0.01	0.23
HNO <sub>3</sub> Extractable Sulfur %	0.30	0.36	0.19
Residual Sulfur, %	0.01	<0.01	0.09
(1) T CaCO <sub>3</sub> /1000 Tons Soil			

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**SOIL ANALYSIS**

Proj. No. 370-02  
Submitted 11/15/94

Sample No.	57304	57305	57306
Location	T1M 6-12-01	S8 0-6-01	T3M 6-12-01
Lime, % as CaCO <sub>3</sub>	4.8	2.0	0.5
Neut. Pot., T/1000 Tons (1)	48	20	5
Acid Pot., T/1000 Tons (1)	16	28	10
Acid/Base Pot., T/1000 Tons (1)	32	-8	-5
Total Sulfur %	1.66	0.91	0.99
Hot H <sub>2</sub> O Extractable Sulfur %	1.15	<0.01	0.66
HCl Extractable Sulfur %	0.07	0.05	0.04
HNO <sub>3</sub> Extractable Sulfur %	0.44	0.78	0.29
Residual Sulfur, %	<0.01	0.08	<0.01
(1) T CaCO <sub>3</sub> /1000 Tons Soil			



## ENERGY LABORATORIES, INC.

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FAX (406) 252-6069 • 1-800-735-4489

## LABORATORY REPORT

TO: Mike Shields  
ADDRESS: Shepherd Miller, Inc.  
1600 Specht Point Drive  
Suite F  
Fort Collins, CO 80525

LAB NO.: 94-57274-57554  
DATE: 12/07/94 da

SOIL ANALYSIS

Proj. No. 370-02  
Submitted 11/15/94

Sample No.	57307	57308	57309
Location	T2M 0-6-01	T2M 0-6-02	TIL2 6-12-01
Lime, % as CaCO <sub>3</sub>	<0.1	0.5	6.1
Neut. Pot., T/1000 Tons (1)	<1	5	61
Acid Pot., T/1000 Tons (1)	14	14	14
Acid/Base Pot., T/1000 Tons (1)	-14	-9	47
Total Sulfur %	1.16	1.05	0.52
Hot H <sub>2</sub> O Extractable Sulfur %	0.71	0.59	0.08
HCl Extractable Sulfur %	0.14	0.11	<0.01
HNO <sub>3</sub> Extractable Sulfur %	0.31	0.35	0.41
Residual Sulfur, %	<0.01	<0.01	0.03

(1) T CaCO<sub>3</sub>/1000 Tons Soil

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Proj. No. 370-02  
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Sample No.	57310	57311	57312
Location	S5 0-6-01	T4M 6-12-01	T7L 6-12-01
Lime, % as CaCO <sub>3</sub>	3.7	0.6	<0.1
Neut. Pot., T/1000 Tons (1)	37	6	<1
Acid Pot., T/1000 Tons (1)	29	18	5
Acid/Base Pot., T/1000 Tons (1)	8	-11	-5
Total Sulfur %	0.96	1.18	0.29
Hot H <sub>2</sub> O Extractable Sulfur %	0.03	0.62	0.13
HCl Extractable Sulfur %	<0.01	0.19	0.01
HNO <sub>3</sub> Extractable Sulfur %	0.82	0.30	0.13
Residual Sulfur, %	0.11	0.07	0.02
(1) T CaCO <sub>3</sub> /1000 Tons Soil			



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Sample No.	57313	57314	57315
Location	T3M 0-6-01	T7U 6-12-01	T3L 0-6-01
Lime, % as CaCO <sub>3</sub>	0.8	0.3	0.1
Neut. Pot., T/1000 Tons (1)	8	3	1
Acid Pot., T/1000 Tons (1)	39	14	20
Acid/Base Pot., T/1000 Tons (1)	-31	-12	-19
Total Sulfur %	1.30	0.85	1.04
Hot H <sub>2</sub> O Extractable Sulfur %	0.06	0.39	0.40
HCl Extractable Sulfur %	0.28	0.07	0.27
HNO <sub>3</sub> Extractable Sulfur %	0.90	0.33	0.33
Residual Sulfur, %	0.06	0.06	0.04
(1) T CaCO <sub>3</sub> /1000 Tons Soil			



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SOIL ANALYSIS

Proj. No. 370-02  
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Sample No.	57316	57317	57318
Location	T1L 6-12-01	T3U 0-6-01	T3U 0-6-02
Lime, % as CaCO <sub>3</sub>	<0.1	1.8	1.5
Neut. Pot., T/1000 Tons (1)	<1	18	15
Acid Pot., T/1000 Tons (1)	4	69	63
Acid/Base Pot., T/1000 Tons (1)	-4	-52	-48
Total Sulfur %	0.45	2.24	2.19
Hot H <sub>2</sub> O Extractable Sulfur %	0.32	0.03	0.17
HCl Extractable Sulfur %	0.02	<0.01	0.10
HNO <sub>3</sub> Extractable Sulfur %	0.11	2.05	1.76
Residual Sulfur, %	<0.01	0.16	0.16
(1) T CaCO <sub>3</sub> /1000 Tons Soil			

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**SOIL ANALYSIS**

Proj. No. 370-02  
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Sample No.	57319	57320	57321
Location	T3U 0-6-03	T3U 0-6-04	T1L 0-6-01
Lime, % as CaCO <sub>3</sub>	3.5	2.2	0.4
Neut. Pot., T/1000 Tons (1)	35	22	4
Acid Pot., T/1000 Tons (1)	11	14	3
Acid/Base Pot., T/1000 Tons (1)	24	8	1
Total Sulfur %	0.45	0.65	0.57
Hot H <sub>2</sub> O Extractable Sulfur %	0.10	0.20	0.46
HCl Extractable Sulfur %	<0.01	0.01	<0.01
HNO <sub>3</sub> Extractable Sulfur %	0.33	0.37	0.11
Residual Sulfur, %	0.02	0.07	<0.01

(1) T CaCO<sub>3</sub>/1000 Tons Soil



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Proj. No. 370-02  
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Sample No.	57322	57323	57324
Location	T3L	T5U	T5L
	6-12-01	6-12-01	0-6-01
Lime, % as CaCO <sub>3</sub>	<0.1	1.4	8.9
Neut. Pot., T/1000 Tons (1)	<1	14	89
Acid Pot., T/1000 Tons (1)	22	33	38
Acid/Base Pot., T/1000 Tons (1)	-22	-19	51
Total Sulfur %	1.28	1.05	1.32
Hot H <sub>2</sub> O Extractable Sulfur %	0.57	<0.01	0.09
HCl Extractable Sulfur %	0.25	0.03	<0.01
HNO <sub>3</sub> Extractable Sulfur %	0.46	0.93	1.13
Residual Sulfur, %	<0.01	0.09	0.10

(1) T CaCO<sub>3</sub>/1000 Tons Soil



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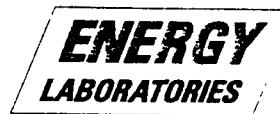
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SOIL ANALYSIS

Proj. No. 370-02  
Submitted 11/15/94

Sample No.	57325	57326	57327
Location	T4L 0-6-01	T4M 0-6-01	T7US 0-6-01
Lime, % as CaCO <sub>3</sub>	<0.1	2.0	1.6
Neut. Pot., T/1000 Tons (1)	<1	20	16
Acid Pot., T/1000 Tons (1)	20	54	38
Acid/Base Pot., T/1000 Tons (1)	-20	-34	-22
Total Sulfur %	1.15	1.76	1.22
Hot H <sub>2</sub> O Extractable Sulfur %	0.52	0.02	<0.01
HCl Extractable Sulfur %	0.24	0.23	<0.01
HNO <sub>3</sub> Extractable Sulfur %	0.36	1.36	1.08
Residual Sulfur, %	0.03	0.15	0.14

(1) T CaCO<sub>3</sub>/1000 Tons Soil

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**SOIL ANALYSIS**

Proj. No. 370-02  
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Sample No.	57328	57329	57330
Location	T7U 0-6-01	T6L 0-6-01	T7L 0-6-01
Lime, % as CaCO <sub>3</sub>	0.6	18.3	1.2
Neut. Pot., T/1000 Tons (1)	6	183	12
Acid Pot., T/1000 Tons (1)	33	22	13
Acid/Base Pot., T/1000 Tons (1)	-27	161	-1
Total Sulfur %	1.83	0.75	0.62
Hot H <sub>2</sub> O Extractable Sulfur %	0.76	0.05	0.19
HCl Extractable Sulfur %	0.17	<0.01	0.02
HNO <sub>3</sub> Extractable Sulfur %	0.82	0.64	0.40
Residual Sulfur, %	0.08	0.06	0.01
(1) T CaCO <sub>3</sub> /1000 Tons Soil			



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SOIL ANALYSIS

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Sample No.	57331	57332	57333
Location	T6U 0-6-01	T6U 0-6-02	T5L 6-12-01
Lime, % as CaCO <sub>3</sub>	4.1	4.6	0.5
Neut. Pot., T/1000 Tons (1)	41	46	5
Acid Pot., T/1000 Tons (1)	60	54	18
Acid/Base Pot., T/1000 Tons (1)	-19	-9	-14
Total Sulfur %	2.21	1.95	0.91
Hot H <sub>2</sub> O Extractable Sulfur %	0.29	0.21	0.33
HCl Extractable Sulfur %	<0.01	0.12	0.19
HNO <sub>3</sub> Extractable Sulfur %	1.70	1.44	0.39
Residual Sulfur, %	0.22	0.18	<0.01
(1) T CaCO <sub>3</sub> /1000 Tons Soil			



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SOIL ANALYSIS

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Sample No.	57334	57335	57336
Location	T6M-0-6	T6L 6-12-01	T6U 6-12-01
Lime, % as CaCO <sub>3</sub>	16.8	19.0	3.2
Neut. Pot., T/1000 Tons (1)	168	190	32
Acid Pot., T/1000 Tons (1)	14	13	54
Acid/Base Pot., T/1000 Tons (1)	154	177	-22
Total Sulfur %	0.71	0.43	1.78
Hot H <sub>2</sub> O Extractable Sulfur %	0.26	<0.01	0.04
HCl Extractable Sulfur %	<0.01	<0.01	0.03
HNO <sub>3</sub> Extractable Sulfur %	0.37	0.35	1.47
Residual Sulfur, %	0.08	0.08	0.24
(1) T CaCO <sub>3</sub> /1000 Tons Soil			

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**SOIL ANALYSIS**

Proj. No. 370-02  
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Sample No.	57337	57338	57339
Location	T6M 6-12-01	T9U 0-6-01	T10US 6-12-01
Lime, % as CaCO <sub>3</sub>	20.5	6.3	3.7
Neut. Pot., T/1000 Tons (1)	205	63	37
Acid Pot., T/1000 Tons (1)	4	20	14
Acid/Base Pot., T/1000 Tons (1)	201	43	22
Total Sulfur %	0.14	0.84	0.49
Hot H <sub>2</sub> O Extractable Sulfur %	<0.01	0.21	0.03
HCl Extractable Sulfur %	<0.01	<0.01	0.07
HNO <sub>3</sub> Extractable Sulfur %	0.08	0.58	0.36
Residual Sulfur, %	0.06	0.05	0.03

(1) T CaCO<sub>3</sub>/1000 Tons Soil



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SOIL ANALYSIS

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Sample No.	57340	57341	57342
Location	T9U 6-12-01	T9US 0-6-01	T9US 0-6-02
Lime, % as CaCO <sub>3</sub>	0.4	6.8	7.5
Neut. Pot., T/1000 Tons (1)	4	68	75
Acid Pot., T/1000 Tons (1)	7	23	24
Acid/Base Pot., T/1000 Tons (1)	-3	44	51
Total Sulfur %	0.66	0.97	0.93
Hot H <sub>2</sub> O Extractable Sulfur %	0.45	0.22	0.15
HCl Extractable Sulfur %	0.01	<0.01	<0.01
HNO <sub>3</sub> Extractable Sulfur %	0.20	0.69	0.72
Residual Sulfur, %	<0.01	0.06	0.06

(1) T CaCO<sub>3</sub>/1000 Tons Soil

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Sample No.	57343	57344	57345
Location	T9L	T9US	T8L
	6-12-01	6-12-01	6-12-01
Lime, % as CaCO <sub>3</sub>	0.6	7.0	30.2
Neut. Pot., T/1000 Tons (1)	6	70	302
Acid Pot., T/1000 Tons (1)	3	22	0
Acid/Base Pot., T/1000 Tons (1)	3	48	302
Total Sulfur %	0.27	0.96	<0.01
Hot H <sub>2</sub> O Extractable Sulfur %	0.18	0.25	<0.01
HCl Extractable Sulfur %	0.03	<0.01	<0.01
HNO <sub>3</sub> Extractable Sulfur %	0.06	0.65	<0.01
Residual Sulfur, %	<0.01	0.06	<0.01

(1) T CaCO<sub>3</sub>/1000 Tons Soil

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Proj. No. 370-02  
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Sample No.	57346	57347	57348
Location	T8U	T8US	T8US
	6-12-01	0-6-01	6-12-01
Lime, % as CaCO <sub>3</sub>	15.6	5.7	4.5
Neut. Pot., T/1000 Tons (1)	156	57	45
Acid Pot., T/1000 Tons (1)	7	36	36
Acid/Base Pot., T/1000 Tons (1)	149	21	8
Total Sulfur %	0.65	1.30	1.41
Hot H <sub>2</sub> O Extractable Sulfur %	0.43	0.15	0.25
HCl Extractable Sulfur %	<0.01	<0.01	<0.01
HNO <sub>3</sub> Extractable Sulfur %	0.19	1.07	1.10
Residual Sulfur, %	0.03	0.08	0.06

(1) T CaCO<sub>3</sub>/1000 Tons Soil

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<b>Sample No.</b>	57349	57350	57351
<b>Location</b>	T8L 0-6-01	T8L 0-6-02	T12M 0-6-01
Lime, % as CaCO <sub>3</sub>	6	26.0	3.0
Neut. Pot., T/1000 Tons (1)	276	260	30
Acid Pot., T/1000 Tons (1)	1	1	50
Acid/Base Pot., T/1000 Tons (1)	275	260	-20
Total Sulfur %	0.02	0.02	2.12
Hot H <sub>2</sub> O Extractable Sulfur %	<0.01	<0.01	0.52
HCl Extractable Sulfur %	<0.01	<0.01	0.10
HNO <sub>3</sub> Extractable Sulfur %	0.02	0.02	1.36
Residual Sulfur, %	<0.01	<0.01	0.14

(1) T CaCO<sub>3</sub>/1000 Tons Soil

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**SOIL ANALYSIS**

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Sample No.	57358	57359	57360
Location	T11M	T11M	T11M
	6-12-02	6-12-03	6-12-04
Lime, % as CaCO <sub>3</sub>	1.5	3.2	2.3
Neut. Pot., T/1000 Tons (1)	15	32	23
Acid Pot., T/1000 Tons (1)	21	12	18
Acid/Base Pot., T/1000 Tons (1)	-6	20	5
Total Sulfur %	0.88	0.47	0.58
Hot H <sub>2</sub> O Extractable Sulfur %	0.22	0.10	<0.01
HCl Extractable Sulfur %	0.02	<0.01	0.08
HNO <sub>3</sub> Extractable Sulfur %	0.53	0.36	0.44
Residual Sulfur, %	0.11	0.01	0.06
(1) T CaCO <sub>3</sub> /1000 Tons Soil			



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SOIL ANALYSIS

Proj. No. 370-02  
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Sample No.	57361	57362	57363
Location	T11M 0-6-01	T10U 6-12-01	T10U 0-6-01
Lime, % as CaCO <sub>3</sub>	2.9	2.2	5.8
Neut. Pot., T/1000 Tons (1)	29	22	58
Acid Pot., T/1000 Tons (1)	46	9	25
Acid/Base Pot., T/1000 Tons (1)	-17	13	33
Total Sulfur %	1.78	0.88	1.18
Hot H <sub>2</sub> O Extractable Sulfur %	0.31	0.60	0.38
HCl Extractable Sulfur %	0.03	<0.01	<0.01
HNO <sub>3</sub> Extractable Sulfur %	1.33	0.28	0.73
Residual Sulfur, %	0.11	<0.01	0.07

(1) T CaCO<sub>3</sub>/1000 Tons Soil



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SOIL ANALYSIS

Proj. No. 370-02  
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Sample No.	57364	57365	57366
Location	T1QL 0-6-01	T13L 0-6-01	T13M 6-12-01
Lime, % as CaCO <sub>3</sub>	0.9	0.5	1.7
Neut. Pot., T/1000 Tons (1)	9	5	17
Acid Pot., T/1000 Tons (1)	15	38	22
Acid/Base Pot., T/1000 Tons (1)	-6	-33	-5
Total Sulfur %	0.59	2.20	1.16
Hot H <sub>2</sub> O Extractable Sulfur %	0.11	0.97	0.45
HCl Extractable Sulfur %	0.06	0.14	<0.01
HNO <sub>3</sub> Extractable Sulfur %	0.38	1.03	0.67
Residual Sulfur, %	0.04	0.06	0.04

(1) T CaCO<sub>3</sub>/1000 Tons Soil

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TO: Mike Shields  
ADDRESS: Shepherd Miller, Inc.  
1600 Specht Point Drive  
Suite F  
Fort Collins, CO 80525

LAB NO.: 94-57274-57554  
DATE: 12/07/94 da

**SOIL ANALYSIS**

Proj. No. 370-02  
Submitted 11/15/94

Sample No.	57352	57353	57354
Location	T12M	T11U	T11L
	6-12-01	6-12-01	6-12-01
Lime, % as CaCO <sub>3</sub>	<0.1	3.6	1.9
Neut. Pot., T/1000 Tons (1)	<1	36	19
Acid Pot., T/1000 Tons (1)	92	2	29
Acid/Base Pot., T/1000 Tons (1)	-92	34	-10
Total Sulfur %	3.73	0.16	1.33
Hot H <sub>2</sub> O Extractable Sulfur %	0.79	0.10	0.39
HCl Extractable Sulfur %	0.16	<0.01	<0.01
HNO <sub>3</sub> Extractable Sulfur %	2.49	0.06	0.84
Residual Sulfur, %	0.29	<0.01	0.10
(1) T CaCO <sub>3</sub> /1000 Tons Soil			

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**SOIL ANALYSIS**

Proj. No. 370-02  
Submitted 11/15/94

Sample No.	57355	57356	57357
Location	T11U 0-6-01	T11L 0-6-01	T11M 6-12-01
Lime, % as CaCO <sub>3</sub>	3.9	6.5	1.5
Neut. Pot., T/1000 Tons (1)	39	65	15
Acid Pot., T/1000 Tons (1)	39	27	20
Acid/Base Pot., T/1000 Tons (1)	-1	39	-5
Total Sulfur %	1.27	1.85	0.87
Hot H <sub>2</sub> O Extractable Sulfur %	0.02	1.00	0.23
HCl Extractable Sulfur %	0.04	<0.01	<0.01
HNO <sub>3</sub> Extractable Sulfur %	1.13	0.79	0.54
Residual Sulfur, %	0.08	0.06	0.10

(1) T CaCO<sub>3</sub>/1000 Tons Soil



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SOIL ANALYSIS

Proj. No. 370-02  
Submitted 11/15/94

Sample No.	57367	57368	57369
Location	T13L 6-12-01	T14M 6-12-01	T14U 0-6-01
Lime, % as CaCO <sub>3</sub>	<0.1	11.2	0.2
Neut. Pot., T/1000 Tons (1)	<1	112	2
Acid Pot., T/1000 Tons (1)	46	27	23
Acid/Base Pot., T/1000 Tons (1)	-46	86	-21
Total Sulfur %	2.56	1.32	1.10
Hot H <sub>2</sub> O Extractable Sulfur %	1.08	0.47	0.37
HCl Extractable Sulfur %	0.20	<0.01	<0.01
HNO <sub>3</sub> Extractable Sulfur %	1.23	0.80	0.70
Residual Sulfur, %	0.05	0.05	0.03

(1) T CaCO<sub>3</sub>/1000 Tons Soil

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**SOIL ANALYSIS**

Proj. No. 370-02  
Submitted 11/15/94

Sample No.	57370	57371	57372
Location	T14L	T14L	T14M
	6-12-01	6-12-02	0-6-01
Lime, % as CaCO <sub>3</sub>	28.8	30.1	5.9
Neut. Pot., T/1000 Tons (1)	288	301	59
Acid Pot., T/1000 Tons (1)	0	0	42
Acid/Base Pot., T/1000 Tons (1)	288	301	18
Total Sulfur %	<0.01	<0.01	1.72
Hot H <sub>2</sub> O Extractable Sulfur %	<0.01	<0.01	0.39
HCl Extractable Sulfur %	<0.01	<0.01	<0.01
HNO <sub>3</sub> Extractable Sulfur %	<0.01	<0.01	1.28
Residual Sulfur, %	<0.01	<0.01	0.05
(1) T CaCO <sub>3</sub> /1000 Tons Soil			



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SOIL ANALYSIS

Proj. No. 370-02  
Submitted 11/15/94

REVISIT H

Sample No.	57373 ✓	57374 ✓	57375
Location	T13M ✓	T18UB ✓	T17L
	0-6-01 ✓	6-12-01 ✓	6-12-01 ✓
Lime, % as CaCO <sub>3</sub>	2.5 ✓	4.8 ✓	3.1 ✓
Neut. Pot., T/1000 Tons (1)	25 ✓	48 ✓	31 ✓
Acid Pot., T/1000 Tons (1)	28 ± 5.3	27 ± 5	1 ± 0.62
Acid/Base Pot., T/1000 Tons (1)	-4 -0.7	21 ± 5	30 ✓
Total Sulfur %	1.04	1.09	0.13
Hot H <sub>2</sub> O Extractable Sulfur %	0.13	0.23	0.11
HCl Extractable Sulfur %	<0.01	<0.01	<0.01
HNO <sub>3</sub> Extractable Sulfur %	0.81	0.80	0.02
Residual Sulfur, %	0.10	0.06	<0.01
(1) T CaCO <sub>3</sub> /1000 Tons Soil			



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SOIL ANALYSIS

Proj. No. 370-02  
Submitted 11/15/94

Sample No.	57376	57377	57378
Location	T18L ✓ 6-12-01 ✓	T17L ✓ 0-6-01 ✓	T17M ✓ 6-12-01 ✓
Lime, % as CaCO <sub>3</sub>	0.9	3.7 ✓	0.6 ✓
Neut. Pot., T/1000 Tons (1)	9 ✓	37 ✓	6 ✓
Acid Pot., T/1000 Tons (1)	7 ✓	24 ✓	27 ✓
Acid/Base Pot., T/1000 Tons (1)	2 ✓	13 ✓	-21 ✓
Total Sulfur %	0.50	3.19	0.86
Hot H <sub>2</sub> O Extractable Sulfur %	0.27	2.42	<0.01
HCl Extractable Sulfur %	<0.01	0.69	0.27
HNO <sub>3</sub> Extractable Sulfur %	0.23	0.06	0.55
Residual Sulfur, %	<0.01	0.02	0.04

(1) T CaCO<sub>3</sub>/1000 Tons Soil



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SOIL ANALYSISProj. No. 370-02  
Submitted 11/15/94

Sample No.	57379	57380	57381
Location	T17U 0-6-01	T17M 0-6-01	T16M 6-12-01
Lime, % as CaCO <sub>3</sub>	2.2	3.9	7.3
Neut. Pot., T/1000 Tons (1)	22	39	73
Acid Pot., T/1000 Tons (1)	19	55	29
Acid/Base Pot., T/1000 Tons (1)	3	-16	44
Total Sulfur %	0.79	1.76	1.26
Hot H <sub>2</sub> O Extractable Sulfur %	0.18	<0.01	0.32
HCl Extractable Sulfur %	<0.01	<0.01	<0.01
HNO <sub>3</sub> Extractable Sulfur %	0.49	1.65	0.87
Residual Sulfur, %	0.12	0.11	0.07

(1) T CaCO<sub>3</sub>/1000 Tons Soil



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### SOIL ANALYSIS

Proj. No. 370-02  
Submitted 11/15/94

Sample No.	57382	57383	57384
Location	T16M	T16M	T16M
	6-12-02	6-12-03	6-12-04
Lime, % as CaCO <sub>3</sub>	7.6	3.6	2.2
Neut. Pot., T/1000 Tons (1)	76	36	22
Acid Pot., T/1000 Tons (1)	29	10	15
Acid/Base Pot., T/1000 Tons (1)	47	26	7
Total Sulfur %	1.22	0.47	0.66
Hot H <sub>2</sub> O Extractable Sulfur %	0.30	0.15	0.19
HCl Extractable Sulfur %	<0.01	<0.01	0.01
HNO <sub>3</sub> Extractable Sulfur %	0.86	0.32	0.40
Residual Sulfur, %	0.06	<0.01	0.06
(1) T CaCO <sub>3</sub> /1000 Tons Soil			



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SOIL ANALYSIS

Proj. No. 370-02  
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Sample No.	57385	57386	57387
Location	T16U	T16L	T16L
	0-6-01	0-6-01	6-12-01
Lime, % as CaCO <sub>3</sub>	2.5	0.8	0.7
Neut. Pot., T/1000 Tons (1)	25	8	7
Acid Pot., T/1000 Tons (1)	13	30	48
Acid/Base Pot., T/1000 Tons (1)	13	-23	-41
Total Sulfur %	0.55	1.24	1.71
Hot H <sub>2</sub> O Extractable Sulfur %	0.15	0.27	0.18
HCl Extractable Sulfur %	<0.01	0.01	0.12
HNO <sub>3</sub> Extractable Sulfur %	0.33	0.92	1.35
Residual Sulfur, %	0.07	0.04	0.06

(1) T CaCO<sub>3</sub>/1000 Tons Soil

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**SOIL ANALYSIS**

Proj. No. 370-02  
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Sample No.	57388	57389	57390
Location	T16M 0-6-01	T15M 6-12-01	T15M 6-12-02
Lime, % as CaCO <sub>3</sub>	6.5	7.2	8.6
Neut. Pot., T/1000 Tons (1)	65	72	86
Acid Pot., T/1000 Tons (1)	28	43	42
Acid/Base Pot., T/1000 Tons (1)	37	29	44
Total Sulfur %	1.31	1.58	1.58
Hot H <sub>2</sub> O Extractable Sulfur %	0.43	0.21	0.25
HCl Extractable Sulfur %	<0.01	<0.01	0.08
HNO <sub>3</sub> Extractable Sulfur %	0.81	1.25	1.17
Residual Sulfur, %	0.07	0.12	0.08

(1) T CaCO<sub>3</sub>/1000 Tons Soil

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**LAB NO.:** 94-57274-5755  
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**SOIL ANALYSIS**

Proj. No. 370-02  
Submitted 11/15/94

Sample No.	57391	57392	57393
Location	T15M	T15L	T15U
	0-6-01	6-12-01	6-12-01
Lime, % as CaCO <sub>3</sub>	7.3	9.2	1.4
Neut. Pot., T/1000 Tons (1)	73	92	14
Acid Pot., T/1000 Tons (1)	49	2	18
Acid/Base Pot., T/1000 Tons (1)	24	90	-3
Total Sulfur %	1.57	0.94	0.70
Hot H <sub>2</sub> O Extractable Sulfur %	<0.01	0.88	0.14
HCl Extractable Sulfur %	<0.01	<0.01	0.01
HNO <sub>3</sub> Extractable Sulfur %	1.48	0.04	0.55
Residual Sulfur, %	0.09	0.02	<0.01
(1) T CaCO <sub>3</sub> /1000 Tons Soil			

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**SOIL ANALYSIS**

Proj. No. 370-02  
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Sample No.	57394	57395	57396
Location	T19M 6-12-01	T19U 6-12-01	T19L 0-6-01
Lime, % as CaCO <sub>3</sub>	0.3	2.7	2.7
Neut. Pot., T/1000 Tons (1)	3	27	27
Acid Pot., T/1000 Tons (1)	4	13	37
Acid/Base Pot., T/1000 Tons (1)	-1	14	-10
Total Sulfur %	0.48	0.56	2.16
Hot H <sub>2</sub> O Extractable Sulfur %	0.36	0.16	0.99
HCl Extractable Sulfur %	0.02	<0.01	0.02
HNO <sub>3</sub> Extractable Sulfur %	0.10	0.39	1.09
Residual Sulfur, %	<0.01	0.01	0.06
(1) T CaCO <sub>3</sub> /1000 Tons Soil			

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**SOIL ANALYSIS**

Proj. No. 370-02  
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Sample No.	57397	57398	57399
Location	T19L	T18M	T18U
	6-12-01	0-6-01	0-6-01
Lime, % as CaCO <sub>3</sub>	1.8	1.7	3.8
Neut. Pot., T/1000 Tons (1)	18	17	38
Acid Pot., T/1000 Tons (1)	18	62	27
Acid/Base Pot., T/1000 Tons (1)	0	-45	11
Total Sulfur %	0.79	1.99	0.96
Hot H <sub>2</sub> O Extractable Sulfur %	0.22	<0.01	0.09
HCl Extractable Sulfur %	0.03	0.31	<0.01
HNO <sub>3</sub> Extractable Sulfur %	0.50	1.53	0.81
Residual Sulfur, %	0.04	0.15	0.06

(1) T CaCO<sub>3</sub>/1000 Tons Soil

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**SOIL ANALYSIS**

Proj. No. 370-02  
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Sample No.	57400	57401	57402
Location	T18L	T18L	T18L
0-6-01		0-6-02	0-6-03
Lime, % as CaCO <sub>3</sub>	1.3	0.6	3.4
Neut. Pot., T/1000 Tons (1)	13	6	34
Acid Pot., T/1000 Tons (1)	12	10	11
Acid/Base Pot., T/1000 Tons (1)	0	-4	24
Total Sulfur %	0.41	0.39	0.48
Hot H <sub>2</sub> O Extractable Sulfur %	0.02	0.06	0.14
HCl Extractable Sulfur %	0.06	0.02	<0.01
HNO <sub>3</sub> Extractable Sulfur %	0.33	0.31	0.34
Residual Sulfur, %	<0.01	<0.01	<0.01

(1) T CaCO<sub>3</sub>/1000 Tons Soil



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#### SOIL ANALYSIS

Proj. No. 370-02  
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Sample No.	57403	57404	57405
Location	T18L 0-6-04	T20M2 6-12-01	T20U 0-6-01
Lime, % as CaCO <sub>3</sub>	2.3	<0.1	1.1
Neut. Pot., T/1000 Tons (1)	23	<1	11
Acid Pot., T/1000 Tons (1)	17	12	4
Acid/Base Pot., T/1000 Tons (1)	6	-12	7
Total Sulfur %	0.64	1.18	0.16
Hot H <sub>2</sub> O Extractable Sulfur %	0.10	0.81	0.03
HCl Extractable Sulfur %	0.01	<0.01	<0.01
HNO <sub>3</sub> Extractable Sulfur %	0.48	0.37	0.13
Residual Sulfur, %	0.05	<0.01	<0.01

(1) T CaCO<sub>3</sub>/1000 Tons Soil



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SOIL ANALYSIS

Proj. No. 370-02  
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Sample No.	57406	57407	57408
Location	T21U 0-6-01	T20M2 0-6-01	T20M 6-12-01
Lime, % as CaCO <sub>3</sub>	3.1	<0.1	11.5
Neut. Pot., T/1000 Tons (1)	31	<1	115
Acid Pot., T/1000 Tons (1)	30	17	15
Acid/Base Pot., T/1000 Tons (1)	1	-17	99
Total Sulfur %	0.95	1.21	0.71
Hot H <sub>2</sub> O Extractable Sulfur %	<0.01	0.67	0.22
HCl Extractable Sulfur %	0.02	0.29	<0.01
HNO <sub>3</sub> Extractable Sulfur %	0.89	0.25	0.49
Residual Sulfur, %	0.04	<0.01	<0.01
(1) T CaCO <sub>3</sub> /1000 Tons Soil			



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SOIL ANALYSIS

Proj. No. 370-02  
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Sample No.	57409	57410	57411
Location	T20M	T20U	T21U
	0-6-01	6-12-01	6-12-01
Lime, % as CaCO <sub>3</sub>	2.2	1.6	2.6
Neut. Pot., T/1000 Tons (1)	22	16	26
Acid Pot., T/1000 Tons (1)	37	3	19
Acid/Base Pot., T/1000 Tons (1)	-15	13	7
Total Sulfur %	1.18	0.25	0.71
Hot H <sub>2</sub> O Extractable Sulfur %	<0.01	0.15	0.09
HCl Extractable Sulfur %	0.15	<0.01	0.03
HNO <sub>3</sub> Extractable Sulfur %	0.98	0.10	0.57
Residual Sulfur, %	0.05	<0.01	0.02

(1) T CaCO<sub>3</sub>/1000 Tons Soil



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## LABORATORY REPORT

TO: Mike Shields  
ADDRESS: Shepherd Miller, Inc.  
1600 Specht Point Drive  
Suite F  
Fort Collins, CO 80525

LAB NO.: 94-57274-57554  
DATE: 12/07/94 da

SOIL ANALYSIS

Proj. No. 370-02  
Submitted 11/15/94

Sample No.	57412	57413	57414
Location	T22M 0-6-01	T22M 0-6-02	T21L 0-6-01
Lime, % as CaCO <sub>3</sub>	<0.1	<0.1	1.3
Neut. Pot., T/1000 Tons (1)	<1	<1	13
Acid Pot., T/1000 Tons (1)	16	23	34
Acid/Base Pot., T/1000 Tons (1)	-16	-23	-22
Total Sulfur %	1.18	1.38	2.32
Hot H <sub>2</sub> O Extractable Sulfur %	0.67	0.65	1.22
HCl Extractable Sulfur %	<0.01	0.37	0.18
HNO <sub>3</sub> Extractable Sulfur %	0.48	0.31	0.87
Residual Sulfur, %	0.03	0.05	0.05
(1) T CaCO <sub>3</sub> /1000 Tons Soil			



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SOIL ANALYSIS

Proj. No. 370-02  
Submitted 11/15/94

Sample No.	57415	57416	57417
Location	T22M 6-12-01	T21UB 6-12	T21U 0-6-01
Lime, % as CaCO <sub>3</sub>	<0.1	2.2	3.6
Neut. Pot., T/1000 Tons (1)	<1	22	36
Acid Pot., T/1000 Tons (1)	18	24	29
Acid/Base Pot., T/1000 Tons (1)	-18	-3	7
Total Sulfur %	1.13	0.78	0.94
Hot H <sub>2</sub> O Extractable Sulfur %	0.56	<0.01	<0.01
HCl Extractable Sulfur %	0.13	0.06	<0.01
HNO <sub>3</sub> Extractable Sulfur %	0.40	0.67	0.90
Residual Sulfur, %	0.04	0.05	0.04

(1) T CaCO<sub>3</sub>/1000 Tons Soil



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SOIL ANALYSIS

Proj. No. 370-02  
Submitted 11/15/94

Sample No.	57418	57419	57420
Location	T22L 0-6-01	T21M 0-6-01	T21M 6-12-01
Lime, % as CaCO <sub>3</sub>	0.7	<0.1	<0.1
Neut. Pot., T/1000 Tons (1)	7	<1	<1
Acid Pot., T/1000 Tons (1)	20	28	18
Acid/Base Pot., T/1000 Tons (1)	-13	-28	-18
Total Sulfur %	1.17	1.70	0.85
Hot H <sub>2</sub> O Extractable Sulfur %	0.54	0.82	0.28
HCl Extractable Sulfur %	0.26	0.45	0.18
HNO <sub>3</sub> Extractable Sulfur %	0.34	0.35	0.39
Residual Sulfur, %	0.03	0.08	<0.01

(1) T CaCO<sub>3</sub>/1000 Tons Soil



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SOIL ANALYSIS

Proj. No. 370-02  
Submitted 11/15/94

Sample No.	57421	57422	57423
Location	T22L 6-12-01	T20L 6-12-01	E5B301 60-62-01
Lime, % as CaCO <sub>3</sub>	1.3	1.7	2.5
Neut. Pot., T/1000 Tons (1)	13	17	25
Acid Pot., T/1000 Tons (1)	37	36	28
Acid/Base Pot., T/1000 Tons (1)	-23	-19	-3
Total Sulfur %	1.67	1.53	1.02
Hot H <sub>2</sub> O Extractable Sulfur %	0.50	0.38	0.12
HCl Extractable Sulfur %	0.09	<0.01	<0.01
HNO <sub>3</sub> Extractable Sulfur %	1.01	1.09	0.86
Residual Sulfur, %	0.07	0.06	0.04

(1) T CaCO<sub>3</sub>/1000 Tons Soil



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SOIL ANALYSIS

Proj. No. 370-02  
Submitted 11/15/94

Sample No.	57424	57425	57426
Location	E5B301	E5B301	E5B301
	40-42-01	15-17-01	100-102-01
Lime, % as CaCO <sub>3</sub>	2.3	1.8	0.8
Neut. Pot., T/1000 Tons (1)	23	18	8
Acid Pot., T/1000 Tons (1)	33	10	35
Acid/Base Pot., T/1000 Tons (1)	-10	8	-27
Total Sulfur %	1.13	0.35	1.12
Hot H <sub>2</sub> O Extractable Sulfur %	0.08	0.02	<0.01
HCl Extractable Sulfur %	0.13	0.05	0.13
HNO <sub>3</sub> Extractable Sulfur %	0.87	0.23	0.95
Residual Sulfur, %	0.05	0.05	0.04

(1) T CaCO<sub>3</sub>/1000 Tons Soil



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SOIL ANALYSIS

Proj. No. 370-02  
Submitted 11/15/94

Sample No.	57427	57428	57429
Location	E5B301	E5B301	E5B301
	20-22-01	60-62-02	160-162-01
Lime, % as CaCO <sub>3</sub>	1.8	2.5	0.9
Neut. Pot., T/1000 Tons (1)	18	25	9
Acid Pot., T/1000 Tons (1)	17	29	19
Acid/Base Pot., T/1000 Tons (1)	2	-4	-10
Total Sulfur %	0.64	1.02	0.64
Hot H <sub>2</sub> O Extractable Sulfur %	0.11	0.10	0.03
HCl Extractable Sulfur %	0.10	<0.01	0.05
HNO <sub>3</sub> Extractable Sulfur %	0.39	0.87	0.52
Residual Sulfur, %	0.04	0.05	0.04
(1) T CaCO <sub>3</sub> /1000 Tons Soil			



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SOIL ANALYSIS

Proj. No. 370-02  
Submitted 11/15/94

Sample No.	57430	57431	57432
Location	E5B301	E5B301	E5B301
10-12-01	10-12-01	80-82-02	150-152-01
Lime, % as CaCO <sub>3</sub>	1.4	2.0	0.7
Neut. Pot., T/1000 Tons (1)	14	20	7
Acid Pot., T/1000 Tons (1)	10	26	18
Acid/Base Pot., T/1000 Tons (1)	4	-5	-11
Total Sulfur %	0.37	0.90	0.59
Hot H <sub>2</sub> O Extractable Sulfur %	0.06	0.08	0.01
HCl Extractable Sulfur %	0.01	<0.01	0.08
HNO <sub>3</sub> Extractable Sulfur %	0.30	0.78	0.50
Residual Sulfur, %	<0.01	0.04	<0.01

(1) T CaCO<sub>3</sub>/1000 Tons Soil

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**SOIL ANALYSIS**

Proj. No. 370-02  
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Sample No.	57433	57434	57435
Location	E5B301	E5B301	E5B301
	60-62-03	50-52-01	130-132-01
Lime, % as CaCO <sub>3</sub>	3.4	3.4	0.7
Neut. Pot., T/1000 Tons (1)	34	34	7
Acid Pot., T/1000 Tons (1)	13	23	12
Acid/Base Pot., T/1000 Tons (1)	21	10	-4
Total Sulfur %	0.46	0.86	0.43
Hot H <sub>2</sub> O Extractable Sulfur %	0.04	0.11	0.06
HCl Extractable Sulfur %	0.05	0.01	<0.01
HNO <sub>3</sub> Extractable Sulfur %	0.35	0.67	0.35
Residual Sulfur, %	0.02	0.07	0.02

(1) T CaCO<sub>3</sub>/1000 Tons Soil

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**SOIL ANALYSIS**

Proj. No. 370-02  
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Sample No.	57436	57437	57438
Location	E5B301	E5B301	E5B301
	130-132-02	60-62-04	90-92-01
Lime, % as CaCO <sub>3</sub>	0.8	2.4	1.8
Neut. Pot., T/1000 Tons (1)	8	24	18
Acid Pot., T/1000 Tons (1)	12	18	35
Acid/Base Pot., T/1000 Tons (1)	-3	7	-17
Total Sulfur %	0.43	0.59	1.14
Hot H <sub>2</sub> O Extractable Sulfur %	0.05	0.03	0.01
HCl Extractable Sulfur %	0.02	0.02	0.07
HNO <sub>3</sub> Extractable Sulfur %	0.36	0.47	1.01
Residual Sulfur, %	<0.01	0.07	0.05

(1) T CaCO<sub>3</sub>/1000 Tons Soil



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SOIL ANALYSIS

Proj. No. 370-02  
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Sample No.	57439	57440	57441
Location	E5B301	NETL-449D	NETL-449D
	140-142-01	43-9-01	89-10-01
Lime, % as CaCO <sub>3</sub>	0.3	1.5	0.5
Neut. Pot., T/1000 Tons (1)	3	15	5
Acid Pot., T/1000 Tons (1)	13	25	24
Acid/Base Pot., T/1000 Tons (1)	-11	-10	-19
Total Sulfur %	0.49	0.86	0.81
Hot H <sub>2</sub> O Extractable Sulfur %	0.06	0.05	0.04
HCl Extractable Sulfur %	0.03	0.10	0.06
HNO <sub>3</sub> Extractable Sulfur %	0.40	0.68	0.70
Residual Sulfur, %	<0.01	0.03	0.01

(1) T CaCO<sub>3</sub>/1000 Tons Soil



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SOIL ANALYSIS

Proj. No. 370-02  
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Sample No.	57442	57443	57444
Location	NETL-449D	NETL-449D	NETL-449D
	125-06-01	83-3-01	88-4-01
Lime, % as CaCO <sub>3</sub>	0.4	0.6	0.9
Neut. Pot., T/1000 Tons (1)	4	6	9
Acid Pot., T/1000 Tons (1)	17	14	20
Acid/Base Pot., T/1000 Tons (1)	-13	-9	-11
Total Sulfur %	0.55	0.47	0.78
Hot H <sub>2</sub> O Extractable Sulfur %	<0.01	0.01	0.14
HCl Extractable Sulfur %	0.15	0.07	<0.01
HNO <sub>3</sub> Extractable Sulfur %	0.38	0.38	0.64
Residual Sulfur, %	0.02	0.01	<0.01

(1) T CaCO<sub>3</sub>/1000 Tons Soil



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SOIL ANALYSIS

Proj. No. 370-02  
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Sample No.	57445	57446	57447
Location	NETL-449D 124-4-01	NETL-449D 115-2-01	NETL-449D 113-0-01
Lime, % as CaCO <sub>3</sub>	0.3	0.2	0.5
Neut. Pot., T/1000 Tons (1)	3	2	5
Acid Pot., T/1000 Tons (1)	7	18	18
Acid/Base Pot., T/1000 Tons (1)	-4	-16	-12
Total Sulfur %	0.35	0.73	0.70
Hot H <sub>2</sub> O Extractable Sulfur %	0.12	0.16	0.14
HCl Extractable Sulfur %	<0.01	0.07	<0.01
HNO <sub>3</sub> Extractable Sulfur %	0.23	0.50	0.56
Residual Sulfur, %	<0.01	<0.01	<0.01
(1) T CaCO <sub>3</sub> /1000 Tons Soil			



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SOIL ANALYSIS

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Sample No.	57448	57449	57450
Location	NETL-449D	NETL-449D	NETL-449D
	49-0-01	150-8-01	138-8-01
Lime, % as CaCO <sub>3</sub>	1.4	0.5	0.3
Neut. Pot., T/1000 Tons (1)	14	5	3
Acid Pot., T/1000 Tons (1)	32	10	28
Acid/Base Pot., T/1000 Tons (1)	-18	-5	-24
Total Sulfur %	1.18	0.45	0.92
Hot H <sub>2</sub> O Extractable Sulfur %	0.17	0.13	0.04
HCl Extractable Sulfur %	<0.01	<0.01	0.05
HNO <sub>3</sub> Extractable Sulfur %	0.99	0.32	0.80
Residual Sulfur, %	0.02	<0.01	0.03
(1) T CaCO <sub>3</sub> /1000 Tons Soil			



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SOIL ANALYSIS

Proj. No. 370-02  
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Sample No.	57451	57452	57453
Location	NETL-449D 158-4-01	NETL-449D 130-1-01	W3B-20-01
Lime, % as CaCO <sub>3</sub>	0.4	0.5	1.3
Neut. Pot., T/1000 Tons (1)	4	5	13
Acid Pot., T/1000 Tons (1)	15	11	15
Acid/Base Pot., T/1000 Tons (1)	-11	-6	-2
Total Sulfur %	0.75	0.41	0.54
Hot H <sub>2</sub> O Extractable Sulfur %	0.28	0.05	0.07
HCl Extractable Sulfur %	<0.01	0.01	<0.01
HNO <sub>3</sub> Extractable Sulfur %	0.47	0.35	0.41
Residual Sulfur, %	<0.01	<0.01	0.06
(1) T CaCO <sub>3</sub> /1000 Tons Soil			

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**SOIL ANALYSIS**

Proj. No. 370-02  
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Sample No.	57454	57455	57456
Location	W3B-20-02	W3B-20-04	W3B-20-03
Lime, % as CaCO <sub>3</sub>	1.4	2.4	3.5
Neut. Pot., T/1000 Tons (1)	14	24	35
Acid Pot., T/1000 Tons (1)	16	14	13
Acid/Base Pot., T/1000 Tons (1)	-3	10	21
Total Sulfur %	0.58	0.58	0.47
Hot H <sub>2</sub> O Extractable Sulfur %	0.06	0.13	0.04
HCl Extractable Sulfur %	0.02	0.02	0.01
HNO <sub>3</sub> Extractable Sulfur %	0.43	0.37	0.39
Residual Sulfur, %	0.07	0.06	0.03

(1) T CaCO<sub>3</sub>/1000 Tons Soil

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**SOIL ANALYSIS**

Proj. No. 370-02  
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Sample No.	57457	57458	57459
Location	NETL-449D 163-8-01	NETL-449D 153-5-01	W3B-30-01
Lime, % as CaCO <sub>3</sub>	0.5	0.2	1.1
Neut. Pot., T/1000 Tons (1)	5	2	11
Acid Pot., T/1000 Tons (1)	3	21	23
Acid/Base Pot., T/1000 Tons (1)	2	-19	-12
Total Sulfur %	0.16	0.79	0.89
Hot H <sub>2</sub> O Extractable Sulfur %	0.07	0.12	0.14
HCl Extractable Sulfur %	<0.01	0.09	0.02
HNO <sub>3</sub> Extractable Sulfur %	0.09	0.58	0.59
Residual Sulfur, %	<0.01	<0.01	0.14

(1) T CaCO<sub>3</sub>/1000 Tons Soil



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SOIL ANALYSIS

Proj. No. 370-02  
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Sample No. Location	57460 W3B-40-01	57461 W3B-50-01	57462 W3B-60-01
Lime, % as CaCO <sub>3</sub>	1.8	1.1	1.2
Neut. Pot., T/1000 Tons (1)	18	11	12
Acid Pot., T/1000 Tons (1)	61	44	34
Acid/Base Pot., T/1000 Tons (1)	-43	-33	-22
Total Sulfur %	2.36	1.42	1.36
Hot H <sub>2</sub> O Extractable Sulfur %	0.40	<0.01	0.27
HCl Extractable Sulfur %	<0.01	0.36	<0.01
HNO <sub>3</sub> Extractable Sulfur %	1.82	1.01	1.01
Residual Sulfur, %	0.14	0.05	0.08

(1) T CaCO<sub>3</sub>/1000 Tons Soil



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SOIL ANALYSIS

Proj. No. 370-02  
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Sample No.	57463 W3B-100-01	57464 W3B-100-02	57465 W3B-140-01
Lime, % as CaCO <sub>3</sub>	0.3	0.4	0.1
Neut. Pot., T/1000 Tons (1)	3	4	1
Acid Pot., T/1000 Tons (1)	19	14	15
Acid/Base Pot., T/1000 Tons (1)	-16	-11	-14
Total Sulfur %	0.60	0.46	0.63
Hot H <sub>2</sub> O Extractable Sulfur %	<0.01	<0.01	0.14
HCl Extractable Sulfur %	<0.01	0.07	<0.01
HNO <sub>3</sub> Extractable Sulfur %	0.59	0.37	0.49
Residual Sulfur, %	0.01	0.02	<0.01

(1) T CaCO<sub>3</sub>/1000 Tons Soil

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FAX (406) 252-6069 • 1-800-735-4489**LABORATORY REPORT**

TO: Mike Shields  
ADDRESS: Shepherd Miller, Inc.  
1600 Specht Point Drive  
Suite F  
Fort Collins, CO 80525

LAB NO.: 94-57274-57554  
DATE: 12/07/94 da

**SOIL ANALYSIS**

Proj. No. 370-02  
Submitted 11/15/94

Sample No.	57466	57467	57468
Location	W4A307	W4A307	W4A307
	130-132-01	150-152-01	110-112-01
Lime, % as CaCO <sub>3</sub>	1.0	0.7	1.3
Neut. Pot., T/1000 Tons (1)	10	7	13
Acid Pot., T/1000 Tons (1)	10	15	20
Acid/Base Pot., T/1000 Tons (1)	-0	-7	-7
Total Sulfur %	0.41	0.53	0.69
Hot H <sub>2</sub> O Extractable Sulfur %	0.08	0.06	0.06
HCl Extractable Sulfur %	<0.01	<0.01	<0.01
HNO <sub>3</sub> Extractable Sulfur %	0.33	0.47	0.62
Residual Sulfur, %	<0.01	<0.01	0.01

(1) T CaCO<sub>3</sub>/1000 Tons Soil



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SOIL ANALYSIS

Proj. No. 370-02  
Submitted 11/15/94

Sample No.	57469	57470	57471
Location	W4A307	W4A307	W4A307
	120-122-01	100-102-01	100-102-02
Lime, % as CaCO <sub>3</sub>	1.1	1.1	1.1
Neut. Pot., T/1000 Tons (1)	11	11	11
Acid Pot., T/1000 Tons (1)	11	28	26
Acid/Base Pot., T/1000 Tons (1)	0	-17	-15
Total Sulfur %	0.40	0.97	0.94
Hot H <sub>2</sub> O Extractable Sulfur %	0.05	0.07	0.11
HCl Extractable Sulfur %	<0.01	<0.01	<0.01
HNO <sub>3</sub> Extractable Sulfur %	0.35	0.90	0.83
Residual Sulfur, %	<0.01	<0.01	<0.01

(1) T CaCO<sub>3</sub>/1000 Tons Soil



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SOIL ANALYSIS

Proj. No. 370-02  
Submitted 11/15/94

Sample No.	57472	57473	57474
Location	W4A307	W4A307	W4A307
	100-102-04	90-92-01	70-72-01
Lime, % as CaCO <sub>3</sub>	2.0	2.0	3.2
Neut. Pot., T/1000 Tons (1)	20	20	32
Acid Pot., T/1000 Tons (1)	10	24	31
Acid/Base Pot., T/1000 Tons (1)	10	-4	1
Total Sulfur %	0.64	0.85	1.12
Hot H <sub>2</sub> O Extractable Sulfur %	0.32	0.07	0.14
HCl Extractable Sulfur %	<0.01	<0.01	<0.01
HNO <sub>3</sub> Extractable Sulfur %	0.28	0.75	0.94
Residual Sulfur, %	0.04	0.03	0.04

(1) T CaCO<sub>3</sub>/1000 Tons Soil

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**SOIL ANALYSIS**

Proj. No. 370-02  
Submitted 11/15/94

Sample No.	57475	57476	57477
Location	W4A307	W4A307	W4A307
	80-82-01	170-172-01	160-162-01
Lime, % as CaCO <sub>3</sub>	2.5	0.4	0.7
Neut. Pot., T/1000 Tons (1)	25	4	7
Acid Pot., T/1000 Tons (1)	25	17	13
Acid/Base Pot., T/1000 Tons (1)	1	-12	-6
Total Sulfur %	0.92	0.61	0.48
Hot H <sub>2</sub> O Extractable Sulfur %	0.13	0.08	0.05
HCl Extractable Sulfur %	<0.01	<0.01	<0.01
HNO <sub>3</sub> Extractable Sulfur %	0.78	0.51	0.43
Residual Sulfur, %	0.01	0.02	<0.01

(1) T CaCO<sub>3</sub>/1000 Tons Soil



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SOIL ANALYSIS

Proj. No. 370-02  
Submitted 11/15/94

Sample No.	57478	57479	57480
Location	W4A307	E7B303	E7B303
	100-102-03	30-32-01	40-42-01
Lime, % as CaCO <sub>3</sub>	3.4	2.4	1.8
Neut. Pot., T/1000 Tons (1)	34	24	18
Acid Pot., T/1000 Tons (1)	12	14	25
Acid/Base Pot., T/1000 Tons (1)	21	10	-7
Total Sulfur %	0.47	0.52	0.83
Hot H <sub>2</sub> O Extractable Sulfur %	0.08	0.07	0.02
HCl Extractable Sulfur %	<0.01	<0.01	0.04
HNO <sub>3</sub> Extractable Sulfur %	0.37	0.41	0.72
Residual Sulfur, %	0.02	0.04	0.05
(1) T CaCO <sub>3</sub> /1000 Tons Soil			



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SOIL ANALYSIS

Proj. No. 370-02  
Submitted 11/15/94

Sample No.	57481	57482	57483
Location	W6A	W6A	W6A
	105-15-01	105-30-01	105-40-01
Lime, % as CaCO <sub>3</sub>	7.8	1.1	0.9
Neut. Pot., T/1000 Tons (1)	78	11	9
Acid Pot., T/1000 Tons (1)	49	12	13
Acid/Base Pot., T/1000 Tons (1)	29	-1	-4
Total Sulfur %	1.80	0.38	0.51
Hot H <sub>2</sub> O Extractable Sulfur %	0.23	0.01	0.08
HCl Extractable Sulfur %	0.02	<0.01	<0.01
HNO <sub>3</sub> Extractable Sulfur %	1.43	0.37	0.43
Residual Sulfur, %	0.12	<0.01	<0.01
(1) T CaCO <sub>3</sub> /1000 Tons Soil			



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SOIL ANALYSISProj. No. 370-02  
Submitted 11/15/94

Sample No.	57484	57485	57486
Location	W6A	W6A	W6A
	105-50-01	105-50-02	105-50-03
Lime, % as CaCO <sub>3</sub>	0.9	0.9	3.7
Neut. Pot., T/1000 Tons (1)	9	9	37
Acid Pot., T/1000 Tons (1)	13	12	13
Acid/Base Pot., T/1000 Tons (1)	-3	-3	24
Total Sulfur %	0.48	0.45	0.47
Hot H <sub>2</sub> O Extractable Sulfur %	0.07	0.06	0.06
HCl Extractable Sulfur %	0.04	0.03	<0.01
HNO <sub>3</sub> Extractable Sulfur %	0.37	0.36	0.38
Residual Sulfur, %	<0.01	<0.01	0.03

(1) T CaCO<sub>3</sub>/1000 Tons Soil



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SOIL ANALYSIS

Proj. No. 370-02  
Submitted 11/15/94

Sample No.	57487	57488	57489
Location	W6A	W6A	W6A
	105-50-04	105-60-01	105-80-01
Lime, % as CaCO <sub>3</sub>	2.6	1.1	1.2
Neut. Pot., T/1000 Tons (1)	26	11	12
Acid Pot., T/1000 Tons (1)	17	15	14
Acid/Base Pot., T/1000 Tons (1)	9	-4	-2
Total Sulfur %	0.63	0.58	0.51
Hot H <sub>2</sub> O Extractable Sulfur %	0.08	0.09	0.06
HCl Extractable Sulfur %	0.12	0.01	0.02
HNO <sub>3</sub> Extractable Sulfur %	0.39	0.48	0.42
Residual Sulfur, %	0.04	<0.01	0.01

(1) T CaCO<sub>3</sub>/1000 Tons Soil



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SOIL ANALYSIS

Proj. No. 370-02  
Submitted 11/15/94

Sample No.	57490	57491	57492
Location	W6A	W4A307	W4A307
	105-90-01	40-42-01	30-32-01
Lime, % as CaCO <sub>3</sub>	0.5	2.7	2.7
Neut. Pot., T/1000 Tons (1)	5	27	27
Acid Pot., T/1000 Tons (1)	21	40	24
Acid/Base Pot., T/1000 Tons (1)	-16	-13	3
Total Sulfur %	0.75	1.29	0.90
Hot H <sub>2</sub> O Extractable Sulfur %	0.07	<0.01	0.14
HCl Extractable Sulfur %	0.01	0.06	<0.01
HNO <sub>3</sub> Extractable Sulfur %	0.67	1.18	0.71
Residual Sulfur, %	<0.01	0.05	0.05

(1) T CaCO<sub>3</sub>/1000 Tons Soil



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SOIL ANALYSIS

Proj. No. 370-02  
Submitted 11/15/94

Sample No.	57493	57494	57495
Location	W4A307	W4A307	W4A307
	20-22-01	15-17-01	5-7-01
Lime, % as CaCO <sub>3</sub>	2.1	2.8	4.2
Neut. Pot., T/1000 Tons (1)	21	28	42
Acid Pot., T/1000 Tons (1)	18	25	38
Acid/Base Pot., T/1000 Tons (1)	3	3	4
Total Sulfur %	0.62	0.79	1.25
Hot H <sub>2</sub> O Extractable Sulfur %	0.05	<0.01	0.03
HCl Extractable Sulfur %	<0.01	0.05	0.10
HNO <sub>3</sub> Extractable Sulfur %	0.55	0.71	1.03
Residual Sulfur, %	0.02	0.03	0.09

(1) T CaCO<sub>3</sub>/1000 Tons Soil



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SOIL ANALYSIS

Proj. No. 370-02  
Submitted 11/15/94

Sample No.	57496	57497	57498
Location	W4A307	W10B-100-01	W10B-110-01
10-12-01			
Lime, % as CaCO <sub>3</sub>	2.3	2.8	2.2
Neut. Pot., T/1000 Tons (1)	23	28	22
Acid Pot., T/1000 Tons (1)	24	25	31
Acid/Base Pot., T/1000 Tons (1)	-1	3	-10
Total Sulfur %	0.90	0.93	1.11
Hot H <sub>2</sub> O Extractable Sulfur %	0.12	0.12	0.11
HCl Extractable Sulfur %	0.03	0.01	0.05
HNO <sub>3</sub> Extractable Sulfur %	0.70	0.74	0.93
Residual Sulfur, %	0.05	0.06	0.02
(1) T CaCO <sub>3</sub> /1000 Tons Soil			

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Proj. No. 370-02  
Submitted 11/15/94

Sample No.	57499	57500	57501
Location	W10B-110-02	W10B-120-01	W10B-130-03
Lime, % as CaCO <sub>3</sub>	2.1	1.4	3.8
Neut. Pot., T/1000 Tons (1)	21	14	38
Acid Pot., T/1000 Tons (1)	24	19	10
Acid/Base Pot., T/1000 Tons (1)	-3	-5	28
Total Sulfur %	0.89	0.69	0.45
Hot H <sub>2</sub> O Extractable Sulfur %	0.12	0.08	0.12
HCl Extractable Sulfur %	<0.01	<0.01	<0.01
HNO <sub>3</sub> Extractable Sulfur %	0.74	0.61	0.33
Residual Sulfur, %	0.03	<0.01	<0.01
(1) T CaCO <sub>3</sub> /1000 Tons Soil			



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SOIL ANALYSIS

Proj. No. 370-02  
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Sample No. Location	57502 W10B-130-01	57503 W10B-130-02	57504 W10B-130-04
Lime, % as CaCO <sub>3</sub>	1.2	0.9	2.7
Neut. Pot., T/1000 Tons (1)	12	9	27
Acid Pot., T/1000 Tons (1)	16	14	13
Acid/Base Pot., T/1000 Tons (1)	-4	-5	13
Total Sulfur %	0.50	0.50	0.62
Hot H <sub>2</sub> O Extractable Sulfur %	<0.01	0.06	0.19
HCl Extractable Sulfur %	0.06	0.01	<0.01
HNO <sub>3</sub> Extractable Sulfur %	0.42	0.43	0.38
Residual Sulfur, %	0.02	<0.01	0.05
(1) T CaCO <sub>3</sub> /1000 Tons Soil			

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**SOIL ANALYSIS**

Proj. No. 370-02  
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Sample No. Location	57505 W10B-139-01	57506 W10B-150-01	57507 W10B-160-01
Lime, % as CaCO <sub>3</sub>	1.0	0.9	0.8
Neut. Pot., T/1000 Tons (1)	10	9	8
Acid Pot., T/1000 Tons (1)	11	11	16
Acid/Base Pot., T/1000 Tons (1)	-1	-2	-8
Total Sulfur %	0.39	0.44	0.57
Hot H <sub>2</sub> O Extractable Sulfur %	0.04	0.08	0.05
HCl Extractable Sulfur %	0.03	<0.01	<0.01
HNO <sub>3</sub> Extractable Sulfur %	0.32	0.36	0.52
Residual Sulfur, %	<0.01	<0.01	<0.01

(1) T CaCO<sub>3</sub>/1000 Tons Soil



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SOIL ANALYSIS

Proj. No. 370-02  
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Sample No. Location	57508 W10B-170-01	57509 W10B-179-01	57510 W10B-190-01
Lime, % as CaCO <sub>3</sub>	1.2	0.9	0.4
Neut. Pot., T/1000 Tons (1)	12	9	4
Acid Pot., T/1000 Tons (1)	15	14	22
Acid/Base Pot., T/1000 Tons (1)	-3	-5	-19
Total Sulfur %	0.55	0.56	0.78
Hot H <sub>2</sub> O Extractable Sulfur %	0.07	0.10	0.07
HCl Extractable Sulfur %	<0.01	<0.01	0.03
HNO <sub>3</sub> Extractable Sulfur %	0.48	0.46	0.68
Residual Sulfur, %	<0.01	<0.01	<0.01

(1) T CaCO<sub>3</sub>/1000 Tons Soil



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SOIL ANALYSIS

Proj. No. 370-02  
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Sample No.	57511	57512	57513
Location	E7B303	E7B303	E7B303
	120-122-01	130-132-01	90-92-01
Lime, % as CaCO <sub>3</sub>	1.1	1.5	2.3
Neut. Pot., T/1000 Tons (1)	11	15	23
Acid Pot., T/1000 Tons (1)	12	13	28
Acid/Base Pot., T/1000 Tons (1)	-1	3	-5
Total Sulfur %	0.42	0.45	0.99
Hot H <sub>2</sub> O Extractable Sulfur %	0.05	0.05	0.10
HCl Extractable Sulfur %	<0.01	0.02	<0.01
HNO <sub>3</sub> Extractable Sulfur %	0.35	0.36	0.86
Residual Sulfur, %	0.02	0.02	0.03

(1) T CaCO<sub>3</sub>/1000 Tons Soil



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SOIL ANALYSIS

Proj. No. 370-02  
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Sample No.	57514	57515	57516
Location	E7B303	E7B303	E7B303
	70-72-01	100-102-01	150-152-01
Lime, % as CaCO <sub>3</sub>	2.6	2.3	0.9
Neut. Pot., T/1000 Tons (1)	26	23	9
Acid Pot., T/1000 Tons (1)	26	23	14
Acid/Base Pot., T/1000 Tons (1)	-0	-0	-5
Total Sulfur %	0.96	0.83	0.52
Hot H <sub>2</sub> O Extractable Sulfur %	0.13	0.10	0.06
HCl Extractable Sulfur %	<0.01	0.01	<0.01
HNO <sub>3</sub> Extractable Sulfur %	0.80	0.67	0.46
Residual Sulfur, %	0.03	0.05	<0.01

(1) T CaCO<sub>3</sub>/1000 Tons Soil

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**SOIL ANALYSIS**

Proj. No. 370-02  
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Sample No.	57517	57518	57519
Location	E7B303	E7B303	E7B303
	80-82-01	80-82-02	170-172-01
Lime, % as CaCO <sub>3</sub>	2.4	2.4	0.8
Neut. Pot., T/1000 Tons (1)	24	24	8
Acid Pot., T/1000 Tons (1)	26	28	14
Acid/Base Pot., T/1000 Tons (1)	-1	-4	-6
Total Sulfur %	0.90	0.81	0.52
Hot H <sub>2</sub> O Extractable Sulfur %	0.08	-0.08	0.06
HCl Extractable Sulfur %	<0.01	0.08	<0.01
HNO <sub>3</sub> Extractable Sulfur %	0.78	0.78	0.46
Residual Sulfur, %	0.04	0.03	<0.01

(1) T CaCO<sub>3</sub>/1000 Tons Soil



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FAX (406) 252-6069 • 1-800-735-4489

## LABORATORY REPORT

TO: Mike Shields  
ADDRESS: Shepherd Miller, Inc.  
1600 Specht Point Drive  
Suite F  
Fort Collins, CO 80525

LAB NO.: 94-57274-57554  
DATE: 12/07/94 da

SOIL ANALYSIS

Proj. No. 370-02  
Submitted 11/15/94

Sample No.	57520	57521	57522
Location	E7B303	E7B303	W6A
	50-52-01	60-62-01	105-100-01
Lime, % as CaCO <sub>3</sub>	3.2	2.8	0.4
Neut. Pot., T/1000 Tons (1)	32	28	4
Acid Pot., T/1000 Tons (1)	31	34	4
Acid/Base Pot., T/1000 Tons (1)	0	-6	-0
Total Sulfur %	1.23	1.25	0.18
Hot H <sub>2</sub> O Extractable Sulfur %	0.23	0.16	0.06
HCl Extractable Sulfur %	<0.01	<0.01	<0.01
HNO <sub>3</sub> Extractable Sulfur %	0.93	1.00	0.12
Residual Sulfur, %	0.07	0.09	<0.01
(1) T CaCO <sub>3</sub> /1000 Tons Soil			



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DATE: 12/07/94 da

SOIL ANALYSIS

Proj. No. 370-02  
Submitted 11/15/94

Sample No.	57523	57524	57525
Location	W6A	W6A	OH-MK93
	105-100-02	105-110-01	25-01
Lime, % as CaCO <sub>3</sub>	0.4	39.5	1.3
Neut. Pot., T/1000 Tons (1)	4	395	13
Acid Pot., T/1000 Tons (1)	4	0	23
Acid/Base Pot., T/1000 Tons (1)	0	395	-10
Total Sulfur %	0.19	0.08	0.76
Hot H <sub>2</sub> O Extractable Sulfur %	0.06	0.08	0.03
HCl Extractable Sulfur %	<0.01	<0.01	<0.01
HNO <sub>3</sub> Extractable Sulfur %	0.13	<0.01	0.68
Residual Sulfur, %	<0.01	<0.01	0.05
(1) T CaCO <sub>3</sub> /1000 Tons Soil			



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LAB NO.: 94-57274-57554  
DATE: 12/07/94 da

SOIL ANALYSIS

Proj. No. 370-02  
Submitted 11/15/94

Sample No.	57526	57527	57528
Location	OH-MK93 35-01	OH-MK93 130-01	OH-MK93 140-01
Lime, % as CaCO <sub>3</sub>	1.3	0.8	0.8
Neut. Pot., T/1000 Tons (1)	13	8	8
Acid Pot., T/1000 Tons (1)	23	29	41
Acid/Base Pot., T/1000 Tons (1)	-10	-21	-33
Total Sulfur %	0.89	0.92	1.41
Hot H <sub>2</sub> O Extractable Sulfur %	0.16	<0.01	0.10
HCl Extractable Sulfur %	<0.01	<0.01	0.11
HNO <sub>3</sub> Extractable Sulfur %	0.69	0.87	1.12
Residual Sulfur, %	0.04	0.05	0.08

(1) T CaCO<sub>3</sub>/1000 Tons Soil



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SOIL ANALYSIS

Proj. No. 370-02  
Submitted 11/15/94

Sample No.	57529	57530	57531
Location	001-01	002-01	101-01
Lime, % as CaCO <sub>3</sub>	1.1	1.9	2.0
Neut. Pot., T/1000 Tons (1)	11	19	20
Acid Pot., T/1000 Tons (1)	6	5	11
Acid/Base Pot., T/1000 Tons (1)	5	14	9
Total Sulfur %	0.35	0.23	0.39
Hot H <sub>2</sub> O Extractable Sulfur %	0.15	0.07	0.03
HCl Extractable Sulfur %	<0.01	<0.01	<0.01
HNO <sub>3</sub> Extractable Sulfur %	0.20	0.16	0.34
Residual Sulfur, %	<0.01	<0.01	0.02
(1) T CaCO <sub>3</sub> /1000 Tons Soil			



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SOIL ANALYSIS

Proj. No. 370-02  
Submitted 11/15/94

Sample No.	57532	57533	57534
Location	003-01	DH91	DH91
Lime, % as CaCO <sub>3</sub>	2.1	0.6	0.5
Neut. Pot., T/1000 Tons (1)	21	6	5
Acid Pot., T/1000 Tons (1)	8	13	37
Acid/Base Pot., T/1000 Tons (1)	13	-6	-32
Total Sulfur %	0.37	0.51	1.43
Hot H <sub>2</sub> O Extractable Sulfur %	0.11	0.11	0.24
HCl Extractable Sulfur %	<0.01	0.02	0.03
HNO <sub>3</sub> Extractable Sulfur %	0.22	0.38	1.12
Residual Sulfur, %	0.04	<0.01	0.04
(1) T CaCO <sub>3</sub> /1000 Tons Soil			



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SOIL ANALYSIS

Proj. No. 370-02  
Submitted 11/15/94

Sample No.	57535	57536	57537
Location	DH91 C-8-01	DH91 C-9-01	DH91 C-13-01
Lime, % as CaCO <sub>3</sub>	0.1	0.5	0.4
Neut. Pot., T/1000 Tons (1)	1	5	4
Acid Pot., T/1000 Tons (1)	11	15	15
Acid/Base Pot., T/1000 Tons (1)	-10	-9	-12
Total Sulfur %	0.57	0.55	0.58
Hot H <sub>2</sub> O Extractable Sulfur %	0.22	0.08	0.09
HCl Extractable Sulfur %	0.03	0.04	0.07
HNO <sub>3</sub> Extractable Sulfur %	0.30	0.43	0.42
Residual Sulfur, %	0.02	<0.01	<0.01

(1) T CaCO<sub>3</sub>/1000 Tons Soil

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LAB NO.: 94-57274-57554  
DATE: 12/07/94 da

**SOIL ANALYSIS**

Proj. No. 370-02  
Submitted 11/15/94

Sample No.	57538	57539	57540
Location	DH91 C-14-01	Underflow 5/16-01	Underflow 4/22-01
Lime, % as CaCO <sub>3</sub>	0.2	2.3	1.6
Neut. Pot., T/1000 Tons (1)	2	23	16
Acid Pot., T/1000 Tons (1)	24	114	8
Acid/Base Pot., T/1000 Tons (1)	-23	-91	8
Total Sulfur %	1.01	3.84	0.28
Hot H <sub>2</sub> O Extractable Sulfur %	0.23	0.20	0.04
HCl Extractable Sulfur %	0.32	0.51	0.02
HNO <sub>3</sub> Extractable Sulfur %	0.41	2.75	0.16
Residual Sulfur, %	0.05	0.38	0.06

(1) T CaCO<sub>3</sub>/1000 Tons Soil



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LAB NO.: 94-57274-57554  
DATE: 12/07/94 da

SOIL ANALYSIS

Proj. No. 370-02  
Submitted 11/15/94

Sample No.	57541	57542	57543
Location	Underflow 4/7-01	Underflow 5/6-01	Underflow 1/27/94
Lime, % as CaCO <sub>3</sub>	1.8	1.6	1.7
Neut. Pot., T/1000 Tons (1)	18	16	17
Acid Pot., T/1000 Tons (1)	5	24	10
Acid/Base Pot., T/1000 Tons (1)	13	-8	7
Total Sulfur %	0.23	0.83	0.46
Hot H <sub>2</sub> O Extractable Sulfur %	0.08	0.07	0.13
HCl Extractable Sulfur %	<0.01	0.12	<0.01
HNO <sub>3</sub> Extractable Sulfur %	0.15	0.54	0.19
Residual Sulfur, %	<0.01	0.10	0.14
(1) T CaCO <sub>3</sub> /1000 Tons Soil			

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**TO:** Mike Shields  
**ADDRESS:** Shepherd Miller, Inc.  
1600 Specht Point Drive  
Suite F  
Fort Collins, CO 80525

**LAB NO.:** 94-57274-57554**DATE:** 12/07/94 da**SOIL ANALYSIS**Proj. No. 370-02  
Submitted 11/15/94

Sample No.	57544	57545	57546
Location	Underflow	Overflow	Overflow
	1/25/94	1/26/94	4/22-01
Lime, % as CaCO <sub>3</sub>	2.8	2.2	2.1
Neut. Pot., T/1000 Tons (1)	28	22	21
Acid Pot., T/1000 Tons (1)	13	7	5
Acid/Base Pot., T/1000 Tons (1)	15	15	16
Total Sulfur %	0.56	0.27	0.24
Hot H <sub>2</sub> O Extractable Sulfur %	0.16	0.06	0.08
HCl Extractable Sulfur %	<0.01	<0.01	<0.01
HNO <sub>3</sub> Extractable Sulfur %	0.26	0.21	0.16
Residual Sulfur, %	0.14	<0.01	<0.01
(1) T CaCO <sub>3</sub> /1000 Tons Soil			



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LAB NO.: 94-57274-57554  
DATE: 12/07/94 da

SOIL ANALYSIS

Proj. No. 370-02  
Submitted 11/15/94

Sample No.	57547	57548	57549
Location	Overflow	Overflow	Overflow
	4/29-01	5/06-01	5/16-01
Lime, % as CaCO <sub>3</sub>	1.3	4.0	2.4
Neut. Pot., T/1000 Tons (1)	13	40	24
Acid Pot., T/1000 Tons (1)	3	24	11
Acid/Base Pot., T/1000 Tons (1)	10	16	13
Total Sulfur %	0.14	0.99	0.47
Hot H <sub>2</sub> O Extractable Sulfur %	0.06	0.21	0.13
HCl Extractable Sulfur %	<0.01	<0.01	<0.01
HNO <sub>3</sub> Extractable Sulfur %	0.08	0.72	0.34
Residual Sulfur, %	<0.01	0.06	<0.01

(1) T CaCO<sub>3</sub>/1000 Tons Soil



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DATE: 12/07/94 da

SOIL ANALYSIS

Proj. No. 370-02  
Submitted 11/15/94

Sample No.	57550	57551	57552
Location	Overflow	Overflow	Overflow
5/6-02	5/6-03	5/6-04	
Lime, % as CaCO <sub>3</sub>	4.1	3.7	2.6
Neut. Pot., T/1000 Tons (1)	41	37	26
Acid Pot., T/1000 Tons (1)	26	11	10
Acid/Base Pot., T/1000 Tons (1)	15	26	16
Total Sulfur %	0.95	0.46	0.54
Hot H <sub>2</sub> O Extractable Sulfur %	0.13	0.11	0.22
HCl Extractable Sulfur %	<0.01	<0.01	<0.01
HNO <sub>3</sub> Extractable Sulfur %	0.78	0.35	0.26
Residual Sulfur, %	0.04	<0.01	0.06
(1) T CaCO <sub>3</sub> /1000 Tons Soil			

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LAB NO.: 94-57274-57554  
DATE: 12/07/94 da

**SOIL ANALYSIS**

Proj. No. 370-02  
Submitted 11/15/94

Sample No.	57553	57554
Location	Feed	Feed
	5/6-01	4/29-01
Lime, % as CaCO <sub>3</sub>	1.9	1.5
Neut. Pot., T/1000 Tons (1)	19	15
Acid Pot., T/1000 Tons (1)	12	5
Acid/Base Pot., T/1000 Tons (1)	8	10
Total Sulfur %	0.56	0.24
Hot H <sub>2</sub> O Extractable Sulfur %	0.18	0.08
HCl Extractable Sulfur %	<0.01	<0.01
HNO <sub>3</sub> Extractable Sulfur %	0.35	0.14
Residual Sulfur, %	0.03	0.02
(1) T CaCO <sub>3</sub> /1000 Tons Soil		



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## LABORATORY REPORT

TO: Mike Shields  
ADDRESS: Shepherd Miller, Inc.  
1600 Specht Point Drive  
Suite F  
Fort Collins, CO 80525

LAB NO.: 94-57281,57290,57300 dup  
DATE: 12/07/94 da

QUALITY ASSURANCE-DUPLICATE ANALYSIS

Proj. No. 370-02  
Submitted 11/15/94

Sample No.	57281DUP	57290DUP	57300DUP
Location	S4-0-6-01	S9 6-12-01	T2M 6-12-01
Lime, % as CaCO <sub>3</sub>	1.8	1.7	<0.1
Neut. Pot., T/1000 Tons (1)	18	17	<1
Acid Pot., T/1000 Tons (1)	9	8	16
Acid/Base Pot., T/1000 Tons (1)	9	9	-16
Total Sulfur %	0.35	0.37	1.22
Hot H <sub>2</sub> O Extractable Sulfur %	0.05	0.11	0.70
HCl Extractable Sulfur %	<0.01	<0.01	0.21
HNO <sub>3</sub> Extractable Sulfur %	0.23	0.26	0.30
Residual Sulfur, %	0.07	<0.01	0.01

(1) T CaCO<sub>3</sub>/1000 Tons Soil



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## LABORATORY REPORT

TO: Mike Shields  
ADDRESS: Shepherd Miller, Inc.  
1600 Specht Point Drive  
Suite F  
Fort Collins, CO 80525

LAB NO.: 94-57310,57321,57330 dup  
DATE: 12/07/94 da

QUALITY ASSURANCE-DUPLICATE ANALYSIS

Proj. No. 370-02  
Submitted 11/15/94

Sample No.	57310DUP	57321DUP	57330DUP
Location	S5 0-6-01	T1L 0-6-01	T7L 0-6-01
Lime, % as CaCO <sub>3</sub>	3.8	0.4	1.1
Neut. Pot., T/1000 Tons (1)	38	4	11
Acid Pot., T/1000 Tons (1)	29	3	15
Acid/Base Pot., T/1000 Tons (1)	9	1	-4
Total Sulfur %	1.00	0.57	0.63
Hot H <sub>2</sub> O Extractable Sulfur %	0.08	0.46	0.15
HCl Extractable Sulfur %	<0.01	<0.01	0.05
HNO <sub>3</sub> Extractable Sulfur %	0.82	0.11	0.40
Residual Sulfur, %	0.10	<0.01	0.03
(1) T CaCO <sub>3</sub> /1000 Tons Soil			



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## LABORATORY REPORT

TO: Mike Shields  
ADDRESS: Shepherd Miller, Inc.  
1600 Specht Point Drive  
Suite F  
Fort Collins, CO 80525

LAB NO.: 94-57340,57350,57361 dup  
DATE: 12/07/94 da

QUALITY ASSURANCE-DUPLICATE ANALYSIS

Proj. No. 370-02  
Submitted 11/15/94

Sample No.	57340DUP	57350DUP	57361DUP
Location	T9U 6-12-01	T8L 0-6-02	T11M 0-6-01
Lime, % as CaCO <sub>3</sub>	0.4	26.0	2.9
Neut. Pot., T/1000 Tons (1)	4	260	29
Acid Pot., T/1000 Tons (1)	8	1	46
Acid/Base Pot., T/1000 Tons (1)	-4	260	-17
Total Sulfur %	0.70	0.02	1.78
Hot H <sub>2</sub> O Extractable Sulfur %	0.44	<0.01	0.31
HCl Extractable Sulfur %	0.06	<0.01	0.03
HNO <sub>3</sub> Extractable Sulfur %	0.20	0.02	1.33
Residual Sulfur, %	<0.01	<0.01	0.11

(1) T CaCO<sub>3</sub>/1000 Tons Soil



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## LABORATORY REPORT

TO: Mike Shields  
ADDRESS: Shepherd Miller, Inc.  
1600 Specht Point Drive  
Suite F  
Fort Collins, CO 80525

LAB NO.: 94-57370,57380,57390 dup  
DATE: 12/07/94 da

QUALITY ASSURANCE-DUPLICATE ANALYSIS

Proj. No. 370-02  
Submitted 11/15/94

Sample No.	57370DUP	57380DUP	57390DUP
Location	T14L	T17M	T15M
	6-12-01	0-6-01	6-12-02
Lime, % as CaCO <sub>3</sub>	29.0	3.8	8.7
Neut. Pot., T/1000 Tons (1)	290	38	87
Acid Pot., T/1000 Tons (1)	0	56	43
Acid/Base Pot., T/1000 Tons (1)	290	-18	44
Total Sulfur %	<0.01	1.78	1.59
Hot H <sub>2</sub> O Extractable Sulfur %	<0.01	<0.01	0.20
HCl Extractable Sulfur %	<0.01	<0.01	0.06
HNO <sub>3</sub> Extractable Sulfur %	<0.01	1.61	1.26
Residual Sulfur, %	<0.01	0.17	0.07

(1) T CaCO<sub>3</sub>/1000 Tons Soil



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## LABORATORY REPORT

TO: Mike Shields  
ADDRESS: Shepherd Miller, Inc.  
1600 Specht Point Drive  
Suite F  
Fort Collins, CO 80525

LAB NO.: 94-57400,57410,57420 dup  
DATE: 12/07/94 da

QUALITY ASSURANCE-DUPLICATE ANALYSIS

Proj. No. 370-02  
Submitted 11/15/94

Sample No.	57400DUP	57410DUP	57420DUP
Location	T18L 0-6-01	T20U 6-12-01	T21M 6-12-01
Lime, % as CaCO <sub>3</sub>	1.0	1.6	<0.1
Neut. Pot., T/1000 Tons (1)	10	16	<1
Acid Pot., T/1000 Tons (1)	12	3	17
Acid/Base Pot., T/1000 Tons (1)	-2	13	-17
Total Sulfur %	0.39	0.22	0.84
Hot H <sub>2</sub> O Extractable Sulfur %	0.01	0.11	0.29
HCl Extractable Sulfur %	0.04	<0.01	0.18
HNO <sub>3</sub> Extractable Sulfur %	0.34	0.11	0.37
Residual Sulfur, %	<0.01	<0.01	<0.01
(1) T CaCO <sub>3</sub> /1000 Tons Soil			



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Suite F  
Fort Collins, CO 80525

LAB NO.: 94-57430, 57440, 57450 dup  
DATE: 12/07/94 da

QUALITY ASSURANCE-DUPLICATE ANALYSIS

Proj. No. 370-02  
Submitted 11/15/94

Sample No.	57430DUP	57440DUP	57450DUP
Location	E5B301	NETL-449D	NETL-449D
	10-12-01	43-9-01	138-8-01
Lime, % as CaCO <sub>3</sub>	1.3	1.6	0.4
Neut. Pot., T/1000 Tons (1)	13	16	4
Acid Pot., T/1000 Tons (1)	10	23	28
Acid/Base Pot., T/1000 Tons (1)	3	-6	-23
Total Sulfur %	0.34	0.86	0.92
Hot H <sub>2</sub> O Extractable Sulfur %	0.03	0.14	0.04
HCl Extractable Sulfur %	0.04	0.03	0.07
HNO <sub>3</sub> Extractable Sulfur %	0.27	0.67	0.79
Residual Sulfur, %	<0.01	0.02	0.02
(1) T CaCO <sub>3</sub> /1000 Tons Soil			



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FAX (406) 252-6069 • 1-800-735-4489

## LABORATORY REPORT

TO: Mike Shields  
ADDRESS: Shepherd Miller, Inc.  
1600 Specht Point Drive  
Suite F  
Fort Collins, CO 80525

LAB NO.: 94-57460,57470,57480 dup  
DATE: 12/07/94 da

QUALITY ASSURANCE-DUPLICATE ANALYSIS

Proj. No. 370-02  
Submitted 11/15/94

Sample No.	57460DUP	57470DUP	57480DUP
Location	W3B-40-01	W4A307	E7B303
Lime, % as CaCO <sub>3</sub>	1.8	1.2	1.8
Neut. Pot., T/1000 Tons (1)	18	12	18
Acid Pot., T/1000 Tons (1)	63	28	27
Acid/Base Pot., T/1000 Tons (1)	-45	-16	-9
Total Sulfur %	2.38	0.95	0.88
Hot H <sub>2</sub> O Extractable Sulfur %	0.38	0.06	0.01
HCl Extractable Sulfur %	<0.01	<0.01	0.06
HNO <sub>3</sub> Extractable Sulfur %	1.85	0.89	0.73
Residual Sulfur, %	0.15	<0.01	0.08
(1) T CaCO <sub>3</sub> /1000 Tons Soil			



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## LABORATORY REPORT

TO: Mike Shields  
ADDRESS: Shepherd Miller, Inc.  
1600 Specht Point Drive  
Suite F  
Fort Collins, CO 80525

LAB NO.: 94-57490,57500,57510 dup  
DATE: 12/07/94 da

QUALITY ASSURANCE-DUPLICATE ANALYSIS

Proj. No. 370-02  
Submitted 11/15/94

Sample No.	57490DUP	57500DUP	57510DUP
Location	W6A	W10B-120-01	W10B-190-01
105-90-01			
Lime, % as CaCO <sub>3</sub>	0.4	1.3	0.4
Neut. Pot., T/1000 Tons (1)	4	13	4
Acid Pot., T/1000 Tons (1)	19	17	22
Acid/Base Pot., T/1000 Tons (1)	-16	-4	-18
Total Sulfur %	0.75	0.65	0.78
Hot H <sub>2</sub> O Extractable Sulfur %	0.13	0.11	0.07
HCl Extractable Sulfur %	<0.01	<0.01	0.03
HNO <sub>3</sub> Extractable Sulfur %	0.62	0.54	0.68
Residual Sulfur, %	<0.01	<0.01	<0.01
(1) T CaCO <sub>3</sub> /1000 Tons Soil			



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## LABORATORY REPORT

TO: Mike Shields  
ADDRESS: Shepherd Miller, Inc.  
1600 Specht Point Drive  
Suite F  
Fort Collins, CO 80525

LAB NO.: 94-57520,57530,57540 dup  
DATE: 12/07/94 da

QUALITY ASSURANCE-DUPLICATE ANALYSIS

Proj. No. 370-02  
Submitted 11/15/94

Sample No.	57520DUP	57530DUP	57540DUP
Location	E7B303	002-01	Underflow
50-52-01			4/22-01
Lime, % as CaCO <sub>3</sub>	3.1	1.9	1.6
Neut. Pot., T/1000 Tons (1)	31	19	16
Acid Pot., T/1000 Tons (1)	35	5	9
Acid/Base Pot., T/1000 Tons (1)	-4	14	7
Total Sulfur %	1.23	0.23	0.31
Hot H <sub>2</sub> O Extractable Sulfur %	0.12	0.06	0.03
HCl Extractable Sulfur %	<0.01	<0.01	0.06
HNO <sub>3</sub> Extractable Sulfur %	1.03	0.17	0.16
Residual Sulfur, %	0.08	<0.01	0.06
(1) T CaCO <sub>3</sub> /1000 Tons Soil			

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FAX (406) 252-6069 • 1-800-735-4489

**LABORATORY REPORT**

TO: Mike Shields  
ADDRESS: Shepherd Miller, Inc.  
1600 Specht Point Drive  
Suite F  
Fort Collins, CO 80525

LAB NO.: 94-57549 dup  
DATE: 12/07/94 da

**QUALITY ASSURANCE-DUPLICATE ANALYSIS**

Proj. No. 370-02  
Submitted 11/15/94

Sample No.	57549DUP
Location	Overflow 5/16-01
Lime, % as CaCO <sub>3</sub>	2.4
Neut. Pot., T/1000 Tons (1)	24
Acid Pot., T/1000 Tons (1)	10
Acid/Base Pot., T/1000 Tons (1)	14
Total Sulfur %	0.47
Hot H <sub>2</sub> O Extractable Sulfur %	0.14
HCl Extractable Sulfur %	<0.01
HNO <sub>3</sub> Extractable Sulfur %	0.33
Residual Sulfur, %	<0.01
(1) T CaCO <sub>3</sub> /1000 Tons Soil	

**ENERGY LABORATORIES, INC.**P.O. BOX 30916 • 1107 SOUTH BROADWAY • BILLINGS, MT 59107-0916 • PHONE (406) 252-6325  
FAX (406) 252-6069 • 1-800-735-4489**LABORATORY REPORT**

TO: Mike Shields  
ADDRESS: Shepherd Miller, Inc.  
1600 Specht Point Drive  
Suite F  
Fort Collins, CO 80525

LAB NO.: 94-57274-57554  
DATE: 12/07/94 da

**QUALITY ASSURANCE-CONTROL SOIL ANALYSIS**

This Quality Assurance-Control Soil Analysis was run with  
your Lab Nos. 94-57274 through 94-57554 with the following results:

Sample No. Location	CONTROL SOIL ANALYSIS	TARGET RANGE
Lime, % as CaCO <sub>3</sub>	6.8	3.6 - 7.5
Neut. Pot., T/1000 Tons (1)	68	33 - 77
Acid Pot., T/1000 Tons (1)	5	0 - 9
Acid/Base Pot., T/1000 Tons (1)	63	33 - 74
Total Sulfur %	0.18	0.02 - 0.25
Hot H <sub>2</sub> O Extractable Sulfur %	0.01	0.01 - 0.04
HCl Extractable Sulfur %	<0.01	<0.01
HNO <sub>3</sub> Extractable Sulfur %	0.17	0.01 - 0.20
Residual Sulfur, %	<0.01	<0.01
(1) T CaCO <sub>3</sub> /1000 Tons Soil		

Lab Nos. 94-57274-554

Date 11/15/94

Received by Randa Hoelscher

### SAMPLE CONDITION QA/QC REPORT

This report provides information about the condition of the sample(s) and associated sample custody information on receipt at the laboratory.

Chain-of-custody form completed & signed	<u>Yes</u>	Comments: _____
Chain-of-custody seal properly placed	<u>N/A</u>	Comments: <u>No Seal</u> _____
Chain-of-custody seal intact	<u>N/A</u>	Comments: _____
Signature Match, Chain-of-custody vs. Seal	<u>N/A</u>	Comments: _____
Sample received cold	<u>N/A</u>	Comments: _____
Samples received within holding time	<u>Yes</u>	Comments: _____
Samples received in proper containers and properly preserved	<u>Yes</u>	Comments: _____
Client notified about sample discrepancies	_____	Comments: _____
Who: _____	By: _____	Date/Time: _____

Method of Shipment Federal Express 35251914341/3525191445

Table H.7 Metals Concentrations in Tailing Materials (analysis for metals by EPA method 3050/6010)

Sample ID	Depth	Sample Collection Date	Sample Analysis Date	Arsenic (mg/kg)	Barium (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Selenium (mg/kg)
E5B301	5	12/12/93	6/13/94	14.8	105	0.4	29	1110	5.1	1.3
E5B301	10	12/12/93	6/13/94	5.7	84	0.2	25.9	390	7.2	0.5
E5B301	15	12/12/93	6/13/94	9.8	117	0.3	37.4	700	10	0.8
E5B301	20	12/12/93	6/13/94	10.1	98	0.3	29	650	10.4	0.8
E5B301	30	12/12/93	6/13/94	13.3	158	0.2	33	660	7.7	0.9
E5B301	40	12/12/93	6/13/94	22.7	137	0.2	36.2	700	12.9	1.3
E5B301	50	12/12/93	6/13/94	27.5	200	0.3	66.4	1060	27	1.1
E5B301	60	12/12/93	6/13/94	44.3	198	0.4	56	1010	29.3	1.3
E5B301	70	12/12/93	6/13/94	51	191	0.3	65	1250	25.7	1.7
E5B301	80	12/12/93	6/13/94	27.7	160	0.3	57.4	780	21.4	1
E5B301	90	12/12/93	6/13/94	22.7	202	0.2	44	700	35.5	1.1
E5B301	100	12/12/93	6/13/94	6.9	150	<0.2	29	630	10.9	1.3
E5B301	110	12/12/93	6/13/94	5.6	162	<0.2	44.1	440	12.2	0.7
E5B301	120	12/12/93	6/13/94	12.5	221	0.4	37	590	17	0.8
E5B301	130	12/12/93	6/13/94	13.8	221	0.4	45.8	680	23.5	0.7
E5B301	140	12/12/93	6/13/94	12	159	0.2	27.5	410	13.4	0.6
E5B301	150	12/12/93	6/13/94	21.3	240	0.2	43.4	580	17.5	0.8
E5B301	160	12/12/93	6/13/94	36.3	315	0.3	44	1010	30.4	1.2
E5B301	170	12/12/93	6/13/94	17.7	237	<0.2	42.5	700	18.4	0.8

Table H.7 (Continued) Metals Concentrations in Tailing Materials (analysis for metals by EPA method 3050/6010)

Sample ID	Depth	Sample Collection Date	Sample Analysis Date	Arsenic (mg/kg)	Barium (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Selenium (mg/kg)
E7B303	20	12/2/93	6/13/94	5.5	78	0.4	18.7	570	6.1	0.6
E7B303	30	12/2/93	6/13/94	10.7	112	<0.2	28.4	530	10	0.8
E7B303	40	12/2/93	6/13/94	12	206	0.2	34.7	770	14.1	1.2
E7B303	50	12/2/93	6/13/94	22.6	201	0.02	44.3	900	26.5	1.6
E7B303	60	12/2/93	6/13/94	15.3	183	<0.2	40	790	15.2	1.4
E7B303	70	12/2/93	6/13/94	35.8	235	0.4	52.7	1120	47.3	1.3
E7B303	80	12/2/93	6/13/94	31.3	210	0.4	53	1400	40.8	1.2
E7B303	90	12/2/93	6/13/94	63.1	212	0.3	64.8	1100	33.2	1.2
E7B303	100	12/2/93	6/13/94	30.9	262	0.6	64.8	1370	62.7	1
E7B303	110	12/2/93	6/13/94	22.2	236	0.4	62.5	730	25	0.9
E7B303	120	12/2/93	6/13/94	13.2	237	0.3	76.6	740	27.2	0.7
E7B303	130	12/2/93	6/13/94	12.2	263	0.4	73.4	1320	34.5	1
E7B303	140	12/2/93	6/13/94	17.8	322	0.7	66.6	1000	32.9	0.9
E7B303	150	12/2/93	6/13/94	25.8	280	0.6	55.7	850	30.3	0.8
E7B303	160	12/2/93	6/13/94	33.2	360	0.4	55.5	1080	37.2	1
E7B303	170	12/2/93	6/13/94	22.8	340	0.3	61.5	1070	35.8	1.3
E7B303	180	12/2/93	6/13/94	35.8	256	0.3	40	730	27.4	1
W4A307	5	12/29/93	6/13/94	14.4	128	0.3	32	840	11.2	1.6
W4A307	10	12/29/93	6/13/94	8.4	138	0.3	29	800	8.9	1.4
W4A307	15	12/29/93	6/13/94	16.3	133	0.3	39.9	580	8	1.1
W4A307	20	12/29/93	6/13/94	10.7	122	<0.2	33.1	740	9.4	1

Table H.7 (Continued) Metals Concentrations in Tailing Materials (analysis for metals by EPA method 3050/6010)

Sample ID	Depth	Sample Collection Date	Sample Analysis Date	Arsenic (mg/kg)	Barium (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Selenium (mg/kg)
W4A307	30	12/29/93	6/13/94	27.1	147	0.5	36	1050	52.5	1.6
W4A307	40	12/29/93	6/13/94	10.4	135	<0.2	31.1	580	9.9	1.4
W4A307	50	12/29/93	6/13/94	18.4	133	<0.2	32.2	530	9.4	1.8
W4A307	60	12/29/93	6/13/94	23.2	169	<0.2	41	440	10.6	1.4
W4A307	70	12/29/93	6/13/94	25	262	0.4	71.9	1040	30.4	1.2
W4A307	80	12/29/93	6/13/94	33.7	177	0.2	50.9	700	18.4	1
W4A307	90	12/29/93	6/13/94	75	235	0.3	67.9	660	23.2	1
W4A307	100	12/29/93	6/13/94	16.4	212	0.2	48.8	590	24.6	1
W4A307	110	12/29/93	6/13/94	17.1	219	0.3	68.6	860	27.7	0.7
W4A307	120	12/29/93	6/13/94	8.2	220	0.2	74.5	640	19.9	6
W4A307	130	12/29/93	6/13/94	8.5	207	0.4	62.7	680	21.4	0.7
W4A307	140	12/29/93	6/13/94	17.2	283	1	53	760	31	0.9
W4A307	150	12/29/93	6/13/94	18.2	270	0.5	52.5	760	29	0.7
W4A307	160	12/29/93	6/13/94	33.7	305	0.4	53.4	950	39.1	0.9
W4A307	170	12/29/93	6/13/94	21.8	271	0.3	44.4	1080	32.7	1.2
W4A307	180	12/29/93	6/13/94	41.9	326	0.3	62.6	750	55.3	1.1
W4A307	190	12/29/93	6/13/94	20.4	264	<0.2	46.1	850	32.5	0.9
NETL-449d	31.1	10/24/91	6/13/94	18.2	179	<0.2	37.7	630	14	0.9
NETL-449d	49.0	10/24/91	6/13/94	33.1	175	0.2	42.6	630	19.4	9
NETL-449d	63.7	10/24/91	6/13/94	8.1	172	<0.2	47.3	300	8.7	0.6
NETL-449d	73.3	10/24/91	6/13/94	20.8	159	<0.2	40.5	330	14.7	1.1

STANDARD OPERATING PROCEDURE

**KINETIC TESTING  
BY THE HUMIDITY CELL METHOD**

Part 1: Coarse Rock Samples  
Part 2: Sediment and Crushed Rock Samples

## STANDARD OPERATING PROCEDURE

# **ACID ROCK DRAINAGE KINETIC TESTING HUMIDITY CELL PROCEDURE**

## **BACKGROUND**

Acid rock drainage (ARD) is of concern at sulfide-containing mining sites, and in many coastal areas where materials containing sulfide are to be dredged or drained. Oxidation of pyrite forms acid which may adversely affect water quality and prohibit plant growth due to the liberation of iron, aluminum, manganese, and other metals. The potential of soil and rock material to form acid can be assessed by "static tests" in which the total amount of sulfide material present is measured in relation to the neutralizing capacity. Such tests may overpredict the tendency of a material to form acid because pyrite oxidation is a kinetically slow and often an incomplete reaction.

Kinetic tests such as the humidity cell have been developed (Sobek and others 1978) to simulate field weathering conditions so that acid production by a sample, if any, can be directly observed. The standard humidity cell method has evolved since first being described in the early 1970's (Lawrence 1990, White and Sarini 1993). The humidity cell typically consists of a 3 to 6 inch diameter column into which a prepared sample has been placed for evaluation (Method Part 1, Figure 1). Samples are sized to simulate their condition in the field. To simulate waste rock weathering, a sample of less than 1/2 inch and greater than 2 mm is used, in order to prevent plugging of pore space with fine materials. Cells are run with finer material when necessary, for a sample with a naturally large fraction of fine material or for which only fines are available. Modifications to the test procedure are available for testing sediments and other samples such as mill tailings that are predominantly composed of particles less than 2mm in size (Method Part 2).

In order to address the issue of bias caused by minerals selectively reporting to fine or coarse fractions, ABA analyses are always rerun on material actually placed into columns. In some cases, ABA's are run on both the +2mm and -2mm fraction.

Alternative humidity cell testing procedures have been described for samples that are predominantly composed of particles smaller than 2 mm such as mill tailings (Lawrence, 1990). A modified humidity cell for fine samples consists of a horizontally elongated chamber with air inlet and exit ports above the surface of the material (Method Part 2). Weekly leach cycles are directed across the surface of the tailings cell rather than through the material. In this way a near-saturated condition is maintained in the sample. An alternative testing procedure has been developed where it is desirable to maintain partially drained conditions during testing. A pressure cell, described below, is used for this procedure.

## METHOD PART 1: COARSE SAMPLES

The testing procedure outlined below closely follows the draft ASTM standard being developed by White and Sarini (1993).

### Sample Preparation

A whole rock sample is generally crushed to less than 1/2 inch and the fines generated (< 10 mesh) are removed from the sample and weighed separately. A sample is then prepared which includes both the coarse and fine fraction in the same percentages (by weight) that each fraction comprised in the crushed sample. This is done to address the potential for selective segregation of sulfides into either the coarse (> 2mm) or fine (< 2mm) fraction of the crushed sample, which may affect the sample behavior in the humidity cell. Approximately 1 to 2 kg of sample is initially inoculated with *Thiobacillus ferrooxidans* and is placed in the humidity cell column (Figure 1) to a depth of 10 to 15 cm. Sample compaction is not required.

Prepared samples are subjected to simulated weathering using the alternate humid air, dry air, and water rinse cycles described below. The test is normally conducted for 20 weeks.

### Humidity Cell Weathering Cycles

Air is forced through the humidity cells at a rate of 1 l/min so that oxygen availability is not limiting. Dry air is used for the first three days after extraction and moist air follows for the next three days. Low relative humidity is maintained by passing air through a desiccant chamber. Moist air is created by forcing air through a porous stone immersed in a heated water bath.

Each week the samples are extracted with three pore volumes of a distilled water rinse. Water is slowly added to the cells using a peristaltic pump which delivers water at a rate of 2 ml/min. Solution pH and EC are taken immediately after humidity cell has finished draining. Samples are collected and preserved quickly to prevent chemical changes such as iron oxidation that might affect the dissolved metal or major ion levels.

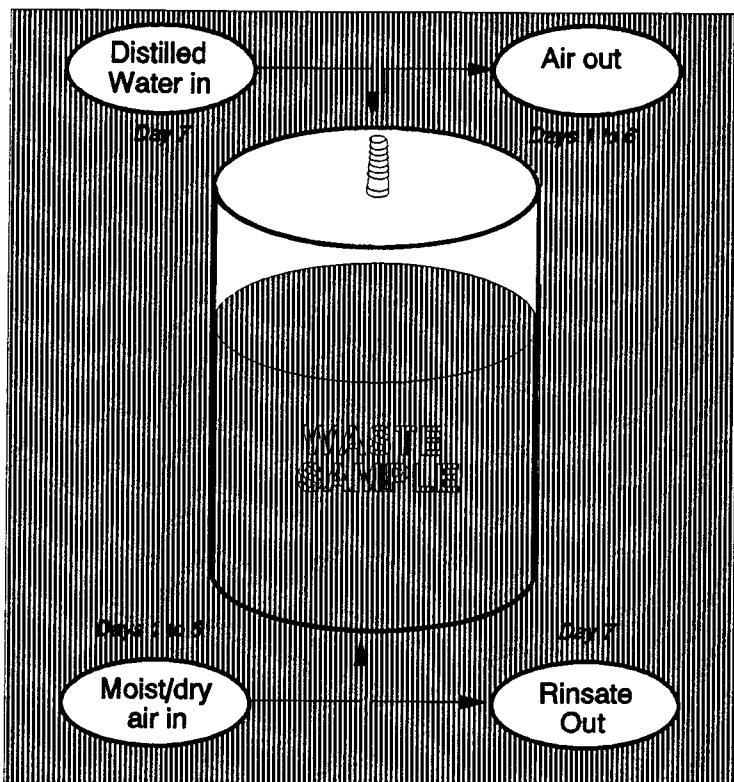
The pore volume amount is determined by:

$$\text{PoreVolume (cm}^3\text{)} = [\frac{\text{weight (g)}}{\text{bulk density (glcm}^3\text{)}}] * \text{porosity(.40)}$$

Weekly rinsing of the humidity cell sample tends to remove oxidation products that may coat the sulfide or carbonate grains. An alternate weathering procedure can be used to simulate the effect of coatings than may form under field conditions. For this procedure, the moist and dry air cycles are applied as described above. The sample is not rinsed until the end of the 20 week weathering period.

For both of the alternate methods described above, samples of rinsate are tested for acidity, alkalinity and sulfate as outlined in the section on sample analysis.

## HUMIDITY CELL ASSEMBLY



### TEST PROCEDURE

**Step 1:** Place 1 to 2 kg waste in 3 to 6 inch diameter clear PVC column. Innoculate with *T. ferrooxidans*.

**Step 2:** Alternate dry and moist air and each week slowly rinse sample with 3 pore volumes of distilled water.

**Step 3:** Analyse rinsate each week for pH, EC, acidity, alkalinity and sulfate. Determine metal levels for selected cycles.

**Step 4:** Plot the pH, EC, sulfate and alkalinity trends. Compare to acid base account data. Assess ARD potential based on results.

*While static tests determine the net potential for a sample to form acid, the humidity cell measures the rate of acid formation. The balance of acid-forming and acid-neutralizing reactions are reflected in rinsate chemistry.*

Figure 1. Schematic of humidity cell chambers.

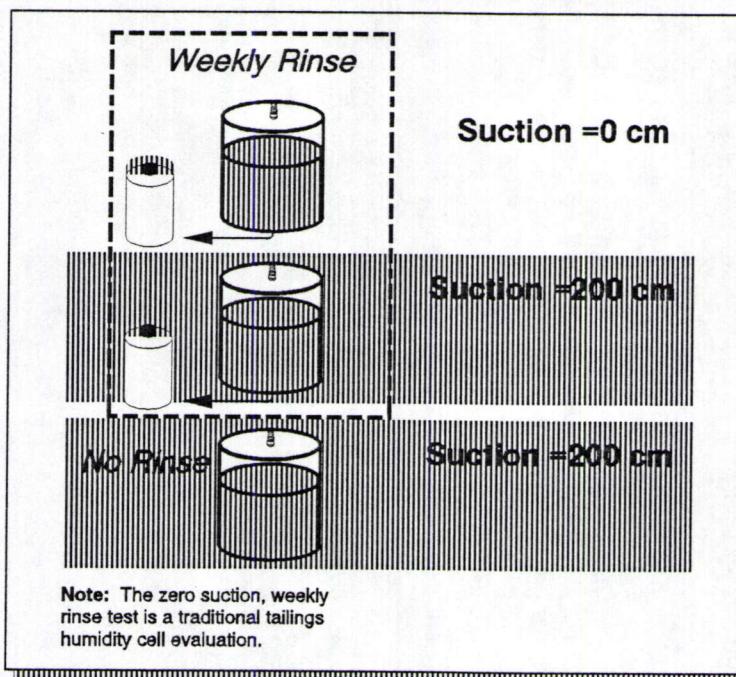
## METHOD PART 2: FINE SAMPLES

### Sample Preparation

Finer-textured samples must be weathered in a different fashion than coarse sample to prevent migration of the fine particles during rinsing. Two test apparatus' can be used for weathering fine samples. In one approach, the sample is placed in the bottom of an elongated cell. Humid and dry air, and rinse water is allowed to pass over the top of the sample rather than leaching through it. The sample maintains near-saturated conditions. This is the test method proposed by Lawrence for tailings samples.

An alternate method is to construct a porous ceramic plate into the bottom of the humidity cell. The cell is then maintained under pressure so that air and rinse solution can be forced to flow through the sample. This method maintains the sample in an unsaturated condition (Figure 2). Samples are prepared and inoculated for wither test method in much the same manner as described in Method Part 1.

## CONTROLLED SUCTION KINETIC TESTS



**Zero suction, weekly rinsed tests** - the traditional method for running humidity cells described by Lawrence (1991). Weekly rinsing facilitates determination of the sulfide oxidation rate and the overall tendency to generate acidic conditions when frequent occurs.

**Applied suction, weekly rinsed tests** - maintain the tailings in an unsaturated condition which is more typical of an embankment or reclaimed tailings. The greater air-filled porosity would tend to accelerate oxidation. The reaction products are more rapidly and completely removed forcing the weekly water rinse solution through the sample.

**Applied suction, unrinsed tests** - allow the reaction products to accumulate in the sample. The effect of coatings on either sulfide or carbonate grains on solution chemistry can be evaluated by leaching the cell at the end of the 20 week reaction cycle.

### Humidity Cell Weathering Cycles

The cycles of moist, and dry air and rinse solution are the same as used in Method Part 1.

## **ANALYSIS OF RINSEATE**

### **Measurement of pH and EC**

Follow manufacturers recommendations for instrument calibration. Reference solutions should include pH 7 and either pH 4 or 10 solution depending on the expected pH of the solution to be measured. A temperature-compensated pH meter should be used when possible. The conductivity bridge is similarly calibrated according to manufacturers recommendation using a standard reference solution.

The pH and EC of samples of rinsate are conducted immediately after sample collection. A subsample is placed in a beaker and is agitated using a magnetic stirrer. The combination pH electrode and EC electrode are immersed in the sample for a sufficient duration to obtain a stable reading.

### **Measurement of Acidity**

Exactly 60 ml of each sample is measured into a Kimax glass beaker. The pH is recorded, if the pH is above 5.0, 5 ml-increments of 0.02 N  $H_2SO_4$  are added to reduce the pH to 5 or less. The sulfuric acid is accurately measured using a titration burette. Next the pH electrodes are removed and 5 drops of 30%  $H_2O_2$  is added and sample is heated to boiling for 2 to 3 minutes. After the sample has cooled to room temperature, pH is again recorded and the volume of each sample is measured. Often during the boiling process, a small portion of the sample is lost to evaporation. Solution volume is brought up to 50 ml. The sample is then titrated to 7.5 and 8.3 endpoints using NaOH. The amount of NaOH is measured and recorded at each pH end point. The acidity expressed as mg/l of  $CaCO_3$  is computed from the normalized strength of the base used for titration.

### **Measurement of Alkalinity**

Exactly 50 ml of each sample is measured into a Kimax glass beaker, and the pH is recorded. Using 0.02N HCl in a titration burette, the volume of acid which is needed to reduce the pH to an end point of 4.5 is recorded. A final pH is measured. The alkalinity is expressed in terms of mg/l of  $CaCO_3$  based on the acid strength.

### **Sulfate Determination**

150 ml of each sample is measured into a Kimax glass beaker. The pH of the sample is recorded. The pH is adjusted with HCl to obtain a pH of 4.5 - 5.0. The pH is again recorded and 1 ml of HCl is added. The sample is heated to boiling. While stirring gently, warm  $BaCl_2$  is slowly added until a white cloudy precipitation appears and reaction appears complete. Then 2 ml of  $BaCl_2$  is added in excess. If the amount of precipitation is small, add a total of 5 ml of  $BaCl_2$  to sample. Digest the slurry at 80 to 90° C for at least 3 hours or overnight. The sample is cooled to room temperature. Using preweighed and numbered 0.45 $\mu m$  cellulose acetate membrane filters, the sample is filtered. The Kimax beaker is rinsed several times with distilled water to remove all the

formed BaSO<sub>4</sub>. A few drops of silicone fluid are added to the sample solution to prevent adherence of the precipitate to the filter apparatus. After the filtering is completed, the filter apparatus is also rinsed with several applications of distilled water until washings are free of Cl, as indicated by testing with AgNO<sub>3</sub>-HNO<sub>3</sub> reagent. The wet filter is then placed on a watch glass and dried in a conventional oven at a temperature of 103-105° C. Filters are then cooled in a desiccator and reweighed. The residue weight is used to calculate sulfate concentrations.

An alternate procedure may be used for automated determination of sulfate using a spectrophotometric method. The automated method (EPA 300.1) is a turbidimetric procedure that uses BaCl<sub>2</sub> addition to precipitate sulfate as BaSO<sub>4</sub>. Standards are prepared using known amounts of sulfate and a standard curve is prepared during instrument calibration. The percent absorbance reading for a sample is used to determine sulfate concentration based on a linear regression fit to the calibration curve.

## TEST INTERPRETATION

Samples that are strongly acid-forming will generate leachate with acid pH levels (less than 4.0), high salinity, and high sulfate concentration within 10 to 20 weeks (Figure 3). Leachates from non acid-forming samples will be near neutral with low sulfate levels (Figure 4). Some samples produce neutral pH solution but generate large amounts of soluble sulfate (Figure 5). This may occur when pyrite oxidizes but the acid formed is consumed by the neutralizing capacity of the rock. The long-term behavior of such samples is uncertain because with continued sulfide oxidation, the neutralizing capacity may eventually be exhausted and acid conditions may result. The "lag time" before development of acid leachate may be many years in the field and a year or more in a humidity cell test.

**Table 1. Typical categories of humidity cell response and their interpretation.**

<b>RESPONSE CATEGORY</b>	<b>DESCRIPTION OF HUMIDITY CELL RESPONSE</b>		<b>INTERPRETATION</b>
	<b>Solution pH</b>	<b>Cumulative Sulfate</b>	
1	Slightly acid to alkaline throughout test ( $\text{pH} > 6$ ), no appreciable acidity.	With or without initial sulfate release (due to gypsum dissolution) but low long-term sulfate release ( $< 50 \text{ mg/kg/week}$ ).	No ARD risk.
2	Slightly acid to alkaline throughout test ( $\text{pH} > 5.5$ ), low levels of acidity.	With or without initial sulfate release but long-term sulfate production is greater than $50 \text{ mg/kg/week}$ and $\text{ABA} > -5 \text{ t/1000t}$ .	ARD risk is low. ARD unlikely to form.
3	Moderately acid to alkaline throughout test ( $\text{pH} > 4.5$ ). If pH initially low, general increase during test. Low to moderate levels of acidity.	Initial sulfate release from gypsum or jarosite. Long-term sulfate production greater than $50 \text{ mg/kg/week}$ and ABA may be $< -5 \text{ t/1000t}$ .	ARD risk is moderate but only likely to form after a significant lag period. ARD unlikely if ABA $> 0$ .
4	pH declining to less than 3.5, development of acid conditions, increasing acidity.	Sulfate release generally increases between week 5 and 20, long-term sulfate release greater than $50 \text{ mg/kg/week}$ .	ARD risk is high.
5	Initially acid ( $< 4.0$ ), with continued production of acidity and possible decrease in pH to $< 3.0$ .	Sulfate release generally very high throughout test, cumulative sulfate generally greater than $2,000 \text{ mg/kg}$ .	Risk of rapid and aggressive formation ARD is high.

## HUMIDITY CELL

### Spent Ore (no lime)

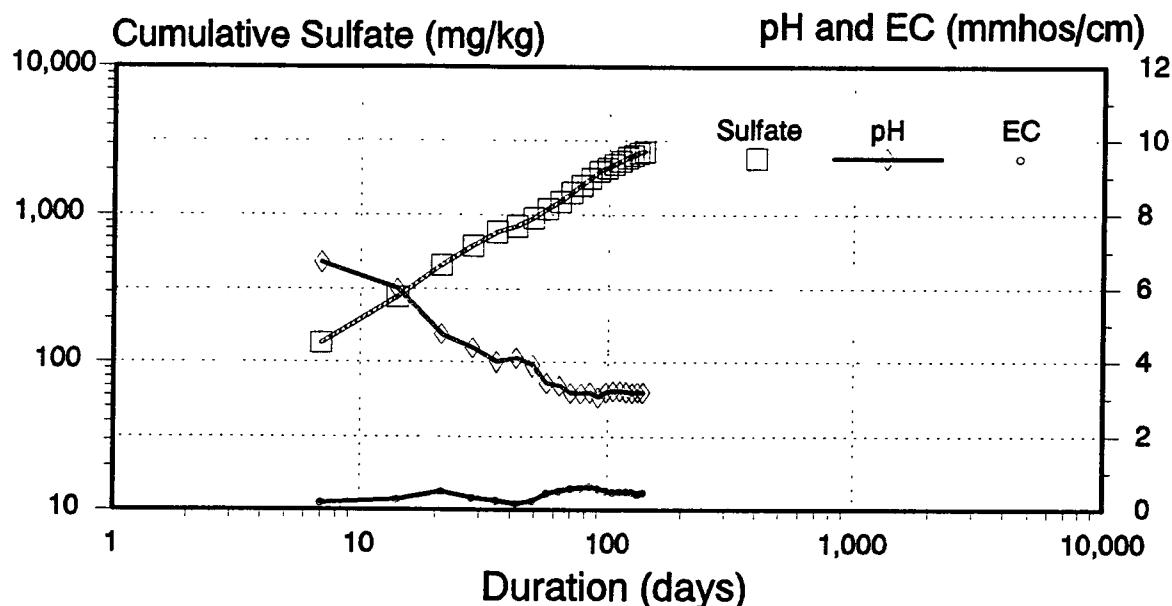


Figure 3. Solution chemistry from humidity cell tests for an acid-forming rock sample.

## HUMIDITY CELL

### Spent Ore (17.8 tons lime/1000 tons)

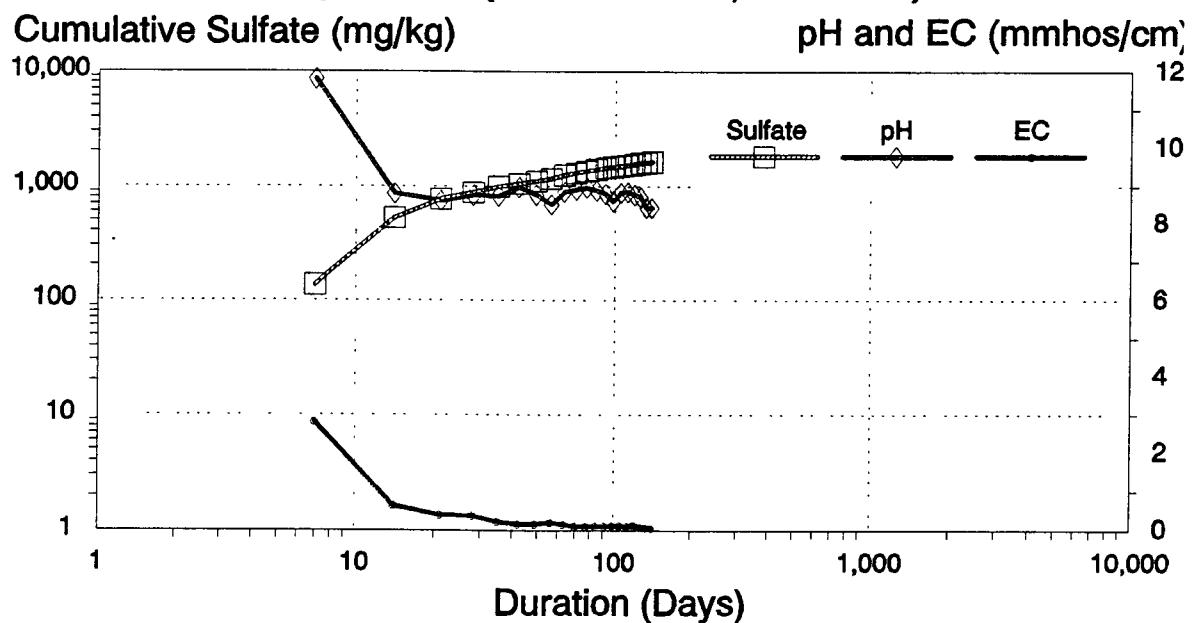
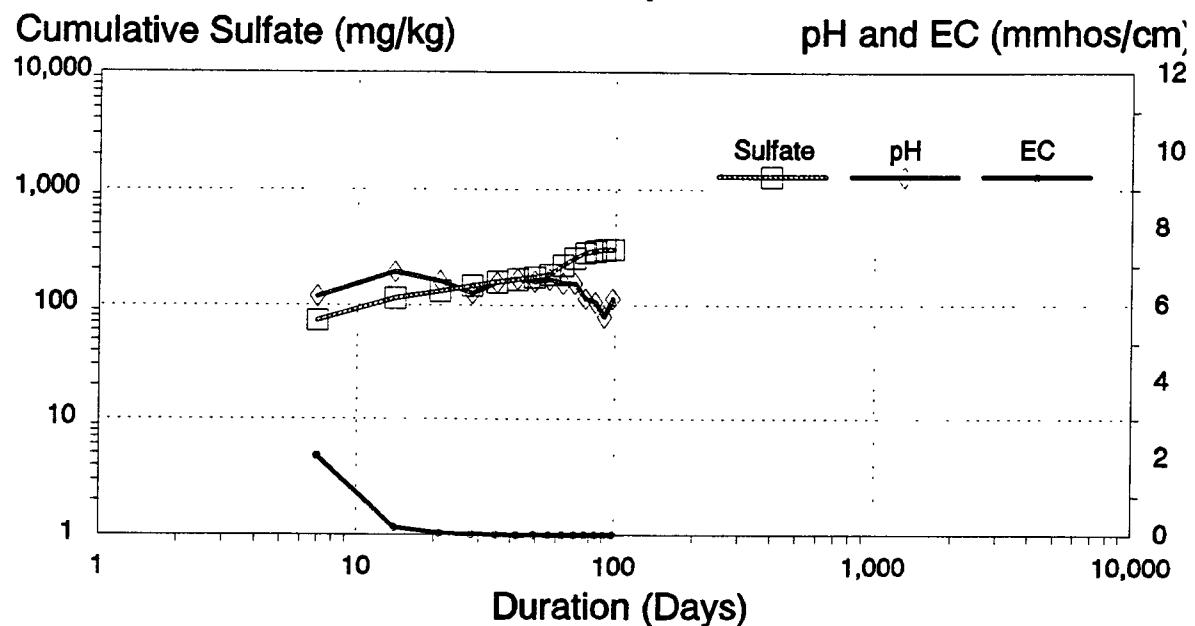


Figure 4. Solution chemistry from humidity cell tests for a non acid-forming rock sample.

# HUMIDITY CELL

## Waste composite



**Figure 5.** Solution chemistry from humidity cell tests for a rock sample where acid generated by sulfide oxidation was internally neutralized by alkaline minerals.

## **REFERENCES**

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- Lawrence RW, 1990. Laboratory Procedures for the Prediction of Long-Term Weathering Characteristics of Mining Wastes. In Acid Mine Drainage: Designing for Closure. Vancouver, BC: BiTech Publishers, pp. 131-140.
- Sobek AA, Schuller WA, Freeman JR, and Smith RM, 1978. Field and Laboratory Methods Applicable to Overburdens and Minesoils. Environmental Protection Agency. Cincinnati, OH: EPA 600/2-78-054.
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This page is a reference page used to track documents internally for the Division of Oil, Gas and Mining

Mine Permit Number M0350015 Mine Name KUC Tailings  
Operator Kennebott Utah Copper Date April 12, 1996  
TO \_\_\_\_\_ FROM \_\_\_\_\_

CONFIDENTIAL  BOND CLOSURE  LARGE MAPS  EXPANDABLE  
 MULTIPUL DOCUMENT TRACKING SHEET  NEW APPROVED NOI  
 AMENDMENT  OTHER \_\_\_\_\_

Description	YEAR-Record Number
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Response to March 26, 1996 letter  
regarding additional information  
for the Tailings Acidification Potential Study

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